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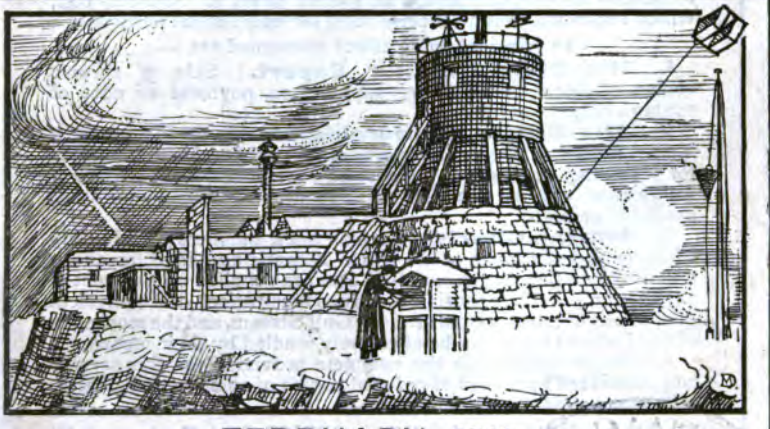
NO. 625 SYMONS'S VOL. 53

METEOROLOGICAL MAGAZINE

EDITED BY HUGH ROBERT MILL



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Edited by HUGH ROBERT MILL, D.Sc., LL.D.

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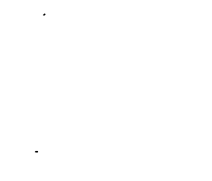

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Symons's Meteorological Magazine.

No. 625. FEBRUARY, 1918. Vol. LIII.

VOL. LIII. No. 625.

The history of this Magazine as of most lives is one of alternate hope and disappointment, of struggle and slackness. At one time it seemed as if increasing support and encouragement were about to justify a course which might lead direct to popularity with profit, again, and now, the utmost we can hope for for months if not years to come is to weather the storm by shortening sail.

It is worth while to make the effort, for this Magazine possesses some elements of usefulness which ought to be preserved. It has the longest history of any journal devoted to meteorology. It makes a feature of giving expression to all sane views however much these may be at variance from orthodox scientific beliefs or from the opinions of the Editor. This is, we are convinced, the proper attitude of the scientific mind, and for our part we should feel far more ashamed of suppressing an unsuspected truth than of involuntarily giving publicity to an error. But if an error should appear we very cordially welcome its refutation.

In these days when the last word on any subject of difficulty is nationalization and the appointment of a Controller with an unlimited staff, we are conscious of being on the unpopular side in supporting individual effort, voluntary organization and consistent economy. We hold very strongly that public departments should assist such work as ours by recognition and even financial aid in emergencies, but without imposing conditions of official control which tend to stifle initiative and lessen responsibility. Experience has convinced us that work of great value is often done by voluntary Observers working not quite in the best way who would rather cease to observe than come under a rigid system of rules and regulations. We try to guide such Observers by endeavouring to increase their enthusiasm to the point which leads them voluntarily to ask for advice.

In a properly regulated State, such as we may dream of after the war, it should not be found impossible, we believe it would be easy, to unite voluntary enthusiasts in willing co-operation in a national system of rainfall observations (for example) which should be supported by public funds. But pending the dawn of that golden day we shall endeavour to render such services and produce such results as the contributions of the faithful and the restrictions of this time of stress admit.

GUNFIRE IN FRANCE, RAINFALL IN ENGLAND.

By The Editor.

Mr. Harries raises a very important point in his letter, published on another page, when he questions the validity of the regional averages used by Mr. Brodie in his article in the January number. We have always been at pains to lay the utmost stress on the importance of using the same period for average rainfalls at stations which have to be compared, and on selecting equally spaced stations when the general rainfall over a district has to be dealt with. How far these rules are followed in the official *Weather Reports* we are not aware; but we give herewith a series of values which are free from any errors of this kind. Time could only be found for dealing with two districts, one the South-East of England (comprising divisions I.-IV. of *British Rainfall*, *i.e.*, the counties to the south-east of a line drawn from the Wash to Portland Bill), the other comprising coastal stations from Sutherland and the Hebrides to the west of Ireland, the one being the nearest, the other the most remote part of the British Isles as viewed from the centre of warlike activity in Flanders. The number of stations differed by one or two in different years; but care was always taken to ensure that the stations employed for any one year gave a true account of the general distribution of rainfall, so that it is quite certain that no one year over-represents the wetter or the drier parts of the district. The average employed in every case was that of the stations used and extended over the 35 years, 1875-1909, except in the case of 1909, when the average was for the 30 years, 1870-1899. The figures for the individual stations are those published annually in Part II. of *British Rainfall* under the title of "Monthly Rainfall . . . the average . . . being taken as 100."

The Tables represent the variations of monthly rainfall from the monthly normals and they will no doubt be interpreted variously by various theorists. In order to facilitate discussion we group the results in a special form by taking the mean percentage for each month in three three-yearly periods, and a final mean for the whole nine years. While a month cannot have less than no rain, or a deficiency of 100 per cent., it may have as much as four times the normal rainfall or an excess of 300 per cent. at an individual station, and probably an excess of 200 per cent. for a whole region of the size of those dealt with. The limits of annual rainfall, on the other hand, range from a deficiency of about 40 per cent. to an excess of about 50 per cent. at individual stations.

A glance at the Tables shows that for both regions the nine years were as a whole wetter than the average, the south-eastern rather more so than the north-western. This increase of rainfall was not uniform throughout the year. In both regions the summer and early autumn months were considerably drier than the average, the

South Eastern Region. Rainfall as per cent. of Average.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
1909	41	34	189	94	86	174	120	94	110	166	34	168	110
1910	107	162	58	116	144	103	107	90	40	80	134	186	109
1911	73	75	116	76	69	102	13	51	70	96	142	204	91
1912	171	97	175	10	67	143	101	267	108	80	86	123	120
1913	169	49	145	154	101	40	78	58	86	129	102	46	95
1914	63	133	239	58	68	68	90	63	46	75	121	273	107
1915	174	196	70	60	161	54	166	90	99	69	106	231	121
1916	74	233	223	77	103	117	54	142	67	112	144	138	121
1917	91	56	113	84	88	118	142	206	76	120	54	62	104
1909-11	74	90	121	95	100	126	80	78	73	114	103	186	103
1912-14	134	93	186	74	79	84	90	129	80	95	103	147	107
1915-17	113	162	135	74	117	96	121	146	81	100	101	144	115
1909-17	107	115	148	81	100	102	97	118	78	103	102	159	109

North Western Region. Rainfall as per cent. of Averaqe.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
1909	120	80	89	156	116	57	113	80	70	128	81	96	97
1910	132	177	88	139	111	98	105	146	36	50	105	76	103
1911	73	130	69	129	94	89	128	73	78	71	114	134	97
1912	77	103	139	113	89	148	96	111	48	104	116	144	109
1913	110	77	150	148	131	128	40	42	79	87	134	108	101
1914	91	189	134	130	94	63	97	97	84	51	128	131	107
1915	129	147	72	155	44	59	124	69	58	57	75	132	94
1916	138	143	58	162	168	87	70	76	63	176	129	93	114
1917	65	38	75	98	88	94	48	104	91	182	178	72	105
1909-11	108	129	82	141	107	81	115	100	61	83	100	102	99
1912-14	93	123	141	130	105	113	78	83	70	81	126	128	106
1915-17	111	109	68	138	100	80	81	83	71	138	127	99	104
1909-17	104	120	97	137	104	91	91	89	67	101	118	110	103

nine years mean showing no excess but in most cases a marked deficiency of rainfall for June, July, August, September and October, and excesses only for the winter and early spring months November, December, January and February. In the north-west April and May were also wet, and in the south-east March and August. The most conspicuous feature is that in both regions September showed a greater deficiency than any other month. We have shown on a previous occasion that the increasing dryness of September has been a feature of the climatology of the British Isles for the past fifty years. We cannot say why this should be so, but the fact is incontestable and the tables show by the three year averages that although the deficiency was greatest in 1909-1911 the slight decrease in the deficiency occurred more in the pre-war years 1912-14 than in the war years 1915-17. It is surely remarkable that during the war not one of the three Septembers had as much as its average rainfall, and we do not suppose that less explosives were consumed in September than in other months. Again, in the south-eastern region the greatest excesses in the three war years occurred in February, March,

August and December. In February and August the war years showed a higher excess than in either of the previous three-yearly periods; but in March, the three-years' period 1912-14, and in December, both the previous three-year periods had greater excesses. Thus if the increase in the wetness of February and August is to be attributed to gun-fire, there must be some other explanation for the reduced wetness of March and December. These are only examples of the arguments which may be drawn from our tables, but they bear very strong evidence to the effect that the abnormalities of the rainfall of the war years are merely the natural development of changes which have certainly been at work for nine years and in one case no less certainly for fifty years.

In the south-eastern region the wettest January, February, July, November and December in the nine years occurred during the war; the wettest of the other seven months before the war. In the north-western region the wettest January, April, May, September, October and November occurred during the war, the other six months before the war. So far as this rough test goes the wettest months during the war were more numerous in the region remoter from the firing.

We may approach the matter also from the point of view of the frequency of wet and dry months in the period of forty-one months commencing in August, 1914, during which the war has been raging, and also in the forty-one months ending in July, 1914, when peace reigned.

Monthly rainfall is so variable that a month which has within 25 per cent. of the average rainfall cannot be treated as significant of either exceptional wetness or dryness, but may be termed *neutral*. A month with from 25 to 50 per cent. below the average may be called *dry*, with more than 50 per cent. below the average, *very dry*; while a month with between 25 and 100 per cent. of excess may be called *wet*, and one with an excess of more than 100 per cent *very wet*. Applying these terms to the two areas we find the following results :—

Number of Months out of 41.

	Very Dry.	Dry.	Neutral.	Wet.	Very Wet.
S.E. before War	5	9	15	9	3
,, during War	1	11	16	8	5
N.W. before War	3	4	20	14	0
,, during War	3	11	12	15	0

A partisan of the belief that gunfire in France influences rainfall in England would, of course, fasten on the fact that immediately before the war there were in the south-east of England 5 very dry months in 41, and during the war only 1; whilst before the war there were only 3 very wet months out of 41, and during the war,5. But in the same period before the war there were 14 dry or very dry months, and 12 wet or very wet months, and during the war 12 dry

or very dry and 18 wet or very wet months, so a single month transferred from one category to the other would bring the result to equality or even reversal. In the north-west of the British Isles in the same two periods very dry months were equally numerous, whilst there were no very wet months. Taking dry and very dry months together there were 7 before, and 14 during the war, and of wet months there were 14 before and 15 during the war.

Much stress has been laid on the relative wetness of the years 1915 and 1916 in the south-east of England, but this fact must be considered in connection with the fact that 1917, when the war was at its intensest phase, was a year of nearly normal fall.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

GUNFIRE AND RAINFALL.

In the preparation of the article on pp. 121-126 of the December number the "Iconoclastic Spirit" was too intent upon spectacular effect to be curbed by the cautionary official foot-note as to the considerable effect produced by changes in the distribution of stations. Some years ago a paper, giving the results of 60 years' rainfall on one of our sugar growing islands, was submitted to me. The conclusion arrived at was alarming. The second half of the period showed that the rainfall was double that of the first half! But the earlier records were taken in the relatively dry residential lowlands along the littoral, whereas the later ones were contributed by from two to three times as many observers, most of them in the wet upland regions of the interior. As no attempt was made to weight the records, the annual mean values of the total number of stations, and the diagram representing them, were entirely misleading.

Proverbially, mere figures can be made to prove anything. Mr. Brodie, taking a perspective view, sees only the large foreground figures of 1917, to the exclusion of those at the vanishing point, in 1881. Lieut. Dobson (p. 189), taking a full-face view of the same figures, arrives at conclusions which demolish Mr. Horner's theory. However, the solution of the problem under discussion is not to be determined by pages of vague statements and suggestions about instances of rain falling during or after some cannonading, while completely ignoring the numerous cases of the noisiest actions in the campaign which have been marked by brilliantly fine and dry weather.

What the readers of your Magazine require for their guidance are accounts of actual experiments proving beyond a doubt that under some if not all conditions noise does produce rain. If this cannot be done—all experiments thus far appear to have been hopeless failures —there is no other alternative than to class the theory with that of the angelic origin of rain given at p. 144, which is not only a far simpler, but a much prettier theory.

HY. HARRIES.

January 20th, 1918.

THE letters from Mr. D. W. Horner which appeared in the September and November issues of your Magazine (pp. 90, 115), and my article which you were good enough to insert in the December issue, have elicited a volume of criticism, mostly of a decidedly unfavourable character.

(1.) Mr. J. Edmund Clark draws attention to the fact that in the course of the past year heavy falls of rain, causing disastrous floods, were experienced in various parts of the Eastern and Southern Hemispheres, and asks, somewhat triumphantly, whether these occurrences could, with any shadow of reason, be associated with the heavy gunfire in France and in Flanders. The reply is that in our own country the feature in the rainfall has been not so much the occurrence of short lived plumps as an excess of precipitation in what may be described as the Continental regions, extending, with a few notable interruptions, over a period of three years.

(2.) Lieut. Gordon Dobson, after a mild reference to my supposed ignorance of sound statistical methods, produces a table, showing, firstly, the number of quarters in which an excess of rain occurred in England S.E. in war and in peace times; and, secondly, for the same periods, the number of quarters in which there was more rain in the south-eastern than in the north-western district. With the first set of figures little fault can be found. It is true that in the three year period, October, 1909, to September, 1912, the number of wet quarters in England, S.E., was practically as large as in the later period, October, 1914, to September, 1917. But Mr. Dobson loses sight of the fact that in the war period the excess of rain in the east and south-east of England was very much greater than in the peace period. No re-arrangement of the figures is capable of masking this feature, which is, to my mind, of considerable importance. If we assume that Mr. Dobson is dealing simply with the meteorological districts known as England, S.E. and England, N.W., and if we are to understand further that the percentage of the average is the thing to be noted my own results below given differ very materially from those of my critic.

Number of Quarters with more rain in S.E. or N.W. Districts.

	Oct. 1914— March 1916	April 1914— Sept 1917	Total (War)	Oct. 1909— March 1911	April 1911— Sept. 1912	Total (Peace)
Excess in S.E. ...	6	4	10	3	2	5
Excess in N.W. ...	0	1	1	1	3	4
Uncertain ..	0	1	1	2	1	3

(3. Mr. Henry Harries attaches much importance to the fact that although gun practice has been for many years past in frequent progress at Shoeburyness the average rainfall in that locality is smaller than in any other part of the United Kingdom. Does Mr. Harries seriously imagine that, as regards air displacement, any comparison may be fairly drawn between the explosions at Shoeburyness and the heavy firing which is in almost constant operation (even on a fairly quiet day) along the Western Front. In the further communication from Mr. Harries, which appears in this issue of the Magazine reference is made to the possible effect of "noise" as a rain producer. For the expression "noise" I should prefer to substitute "violent concussions, producing air waves of unusual magnitude."

(4.) Mr. W. H. Dines evidently regards the whole question as beneath the notice of any serious meteorologist. His Shakespearian quotation appeals to one's sense of humour, but one cannot help thinking that Mr. Dines could "an he would" afford some real enlightenment on a subject which is scarcely capable of solution in the way suggested by our good friend Hotspur.

(5.) Mr. F. J. Wardale shows that in the distant past when big European wars were happily unknown, it was clearly possible for various sections of the United Kingdom to be affected by an excess of rain extending over a long period. He also draws attention to the fact that for many months together there is often a tendency for incoming barometrical depressions to pursue definite paths, sometimes over one portion and at other times over some other portion of this country. The causes of such tendencies remain a profound mystery, and are a serious stumbling block in the way of those who would venture upon long distance weather forecasting.

The conclusion one forms with regard to the question under issue is that, in the opinions of many of our ablest meteorologists, the impossibility of any connection between gunfire and rainfall is so clearly established that further discussion of the subject would be nothing less than a waste of time. There is, on the other hand, a small but not insignificant minority in whose ranks I prefer, for the moment, to stand, whose minds are still open to conviction on the one side or the other. All doubts upon the matter might, I venture to think, be solved by an enquiry conducted upon the following lines :—

(1.) By procuring from official, or other reliable, sources the dates, upon which the bombardments along the Western Front have been unusually heavy and prolonged.

(2.) By examining carefully the daily weather maps and reports for two or three days prior and for about a week subsequent, to the above dates with a view to discovering :—

(*a.*) Whether the barometrical conditions were distinctly unfavourable to the production of rain, and whether in such cases any material precipitation was reported in our eastern and southern districts.

(*b.*) Whether the conditions were of an indefinite type, whether in such cases any rain fell, and whether it was heavier or more general than might have been expected.

(*c.*) Whether the conditions were of a pronounced rainy type, and whether in such cases the precipitation was heavier than might have been expected.

With regard to (*b.*) and (*c.*) some difficulty would arise owing to the impossibility of estimating correctly the quantity of rain which is likely to occur within any given area under favourable rainfall conditions. Some of our heaviest rains, such for instance as the Norfolk fall of August, 1912, and the Somerset fall of June last, appear to have been wholly unexpected; and in the present state of weather knowledge it seems quite impossible to account satisfactorily either for cloudbursts which are purely local, or for others which cover, as in the cases mentioned, a tolerably wide area.

In spite of such difficulties the enquiry suggested would, in all probability, yield results of a sufficiently decisive character to remove all doubts as to the meteorological effect of gunfire, and in the opinion of many of us such a consummation would fully compensate for the time and trouble involved in the investigation.

FREDK. J. BRODIE.

30 Loxley Road, Wandsworth Common, Feb. 10th, 1918.

COLD OF JANUARY 13th.

On January 13th the thermometer fell to —4° on the low ground near the river. On the lawn 90 feet above it it marked 1°. On April 1st, 1917, it marked —5°, and on the lawn 90 feet higher it was 8°. An interesting point is that an Aucuba bush, about 4 feet high, was badly cut in April. The same bush (what remains of it) is as fresh as can be, which shows the effect when the sap was rising and when the plant was at rest.

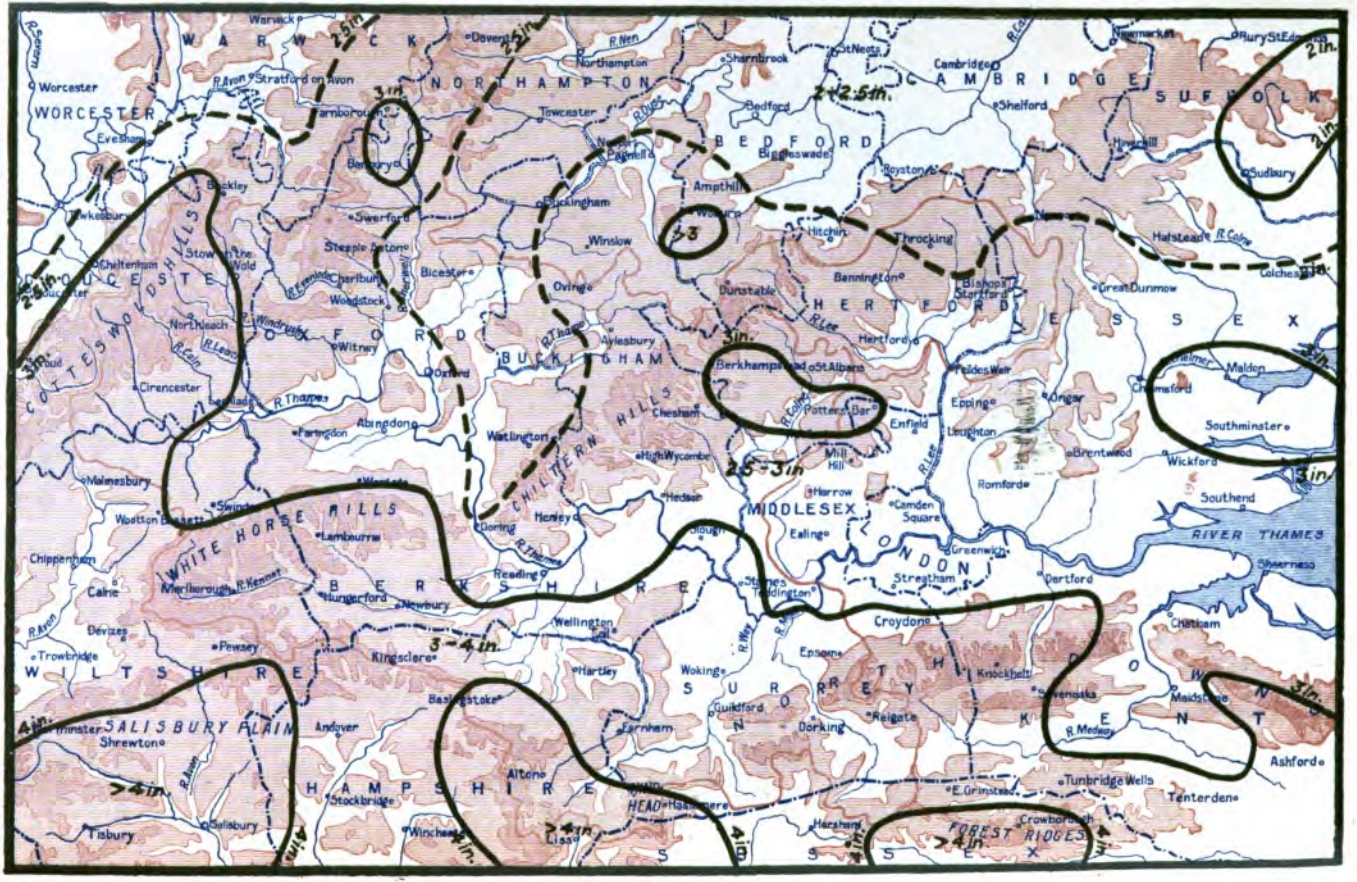
WILLIAM ELLIS.

Bothalhaugh, Morpeth, January 26th, 1918.

Note.—In order to concentrate the interest in the question of the possible influence of gunfire on rainfall, we have left no space this month for a number of interesting matters, including the January meeting of the Royal Meteorological Society, which are held over,

Ed. *S.M.M.*

THAMES VALLEY RAINFALL JANUARY, 1918.



Symons's Meteorological Magazine

Watershed of River Thames above Teddington and River Lee above Feildes Weir

Isohyetals

THE WEATHER OF JANUARY.

THE month was cold in its first half, and remarkably mild during the second half. During the cold period comparatively little snow fell. The distribution of barometric pressure about the middle of the month was complex, but during the first ten days pressure was high off the west of Ireland and low over Scandinavia, while in the last ten days of the month the reverse conditions obtained. The mean temperature of the month taking the country as a whole was in close acccordance with the average, but in the north and east of Scotland was a degree and a half under, and in the north-west of England a degree above the average. The lowest temperatures were recorded in Scotland, on the 14th or 15th, the minima in shade falling to —8°, at West Linton, —1° at Eskdalemuir, and 4°, at Balmoral. In England readings under 12° were confined to northern districts; and at Scilly, on the 14th, the lowest was only 39°. The cold in Scotland was quite exceptional, the Dee and the lower reaches of Loch Lomond being frozen for the first time since the memorable frost of 1895. About the 17th a mild south-westerly current spread over the country, and by the 24th or 25th shade maxima exceeding 55° had been recorded at a large number of places, the maximum values being 58°, at London (Westminster), on the 24th, and at Hawarden Bridge on the 25th. As far north as Gordon Castle a value of 56° was reported on the former day.

Bright sunshine was deficient except on the south coast, where there was an average of three hours a day, while the average in the north of Scotland was only half an hour. The south-east of England was relatively sunny with about two hours hours a day. Compared with the average the dullest weather was experienced over Ireland.

The rainfall was in general above the average, the excess being considerable in the south and west parts of the country, Kerry, the Devon-Cornwall peninsula, Kirkcudbright and Wigtown, for example, all having a heavy rainfall. The actual amounts rose to as much as 10 inches at Killarney, 8 inches on Dartmoor, and 11 inches at Shiel, in Kirkcudbright. Slightly larger amounts fell in the normally wet areas where the excess as compared with the average was, however, slight.

The least rainfall, from 1·50 to 2 inches, was recorded in the central Highlands of Scotland, the north Midlands, the Fen district, and in Kings Co. In our map of the Thames Valley the southern portion of a dry area and the northern part of the wet area near the south coast are included. The general fall expressed as a percentage of the average was :—England and Wales, 123 per cent ; Scotland, 104 per cent. ; Ireland, 110 per cent. ; British Isles, 113 per cent.

In London (Camden Square), the mean temperature was 39°·3, or 0·°8, above the average. The duration of bright sunshine was 29·2 hours, and the duration of rainfall, 61·0 hours. Evaporation, ·14 in.

RAINFALL TABLE FOR JANUARY, 1918.

STATION.	COUNTY.	RAINFALL. Aver. 1875–1909. in.	1918. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Date.	No. of Days
Camden Square	*London*	1·83	2·86	+1·03	156	1·23	15	18
Tenterden	*Kent*	2·14	3·21	+1·07	150	1·49	15	19
Arundel (Patching)	*Sussex*	2·59	3·80	+1·21	147	1·58	15	14
Fordingbridge (Oaklands)	*Hampshire*	2·67	4·48	+1·81	168	1·30	15	19
Oxford (Magdalen College)	*Oxfordshire*	1·78	2·74	+ ·96	154	1·26	15	12
Wellingborough (Swanspool)	*Northampn*	1·90	1·62	— ·28	85	·24	14	17
Bury St. Edmunds (Westley)	*Suffolk*	1·70	2·24	+ ·54	132	·95	15	13
Geldeston [Beccles]	*Norfolk*	1·53	2·73	+1·20	179	1·21	15	21
Polapit Tamar [Launceston]	*Devon*	3·59	5·83	+2·24	163	1·51	15	24
Rousdon [Lyme Regis]	,,	2·94	3·92	+ ·98	133	1·57	15	18
Stroud (Field Place)	*Gloucester*	2·33	3·03	+ ·70	130	·75	19	15
Church Stretton	*Shropshire*	...	3·11	...	..	·51	15	15
Boston	*Lincoln*	1·54	1·68	+ ·14	109	·36	15	19
Worksop (Hodsock Priory)	*Nottingham*	1·70	1·63	— ·07	96	·29	15	15
Mickleover Manor	*Derbyshire*	1·95	2·07	+ ·12	106	·45	19	18
Buxton	,,	4·41	3·91	— ·50	89	·63	9	18
Southport (Hesketh Park)	*Lancashire*	2·55	2·87	+ ·32	113	·79	14	20
Arncliffe Vicarage	*York, W.R.*	6·26	...	...	...	...	...	...
Wetherby (Ribston Hall)	,, ,,	1·89	2·28	+ ·39	121	·62	18	9
Hull (Pearson Park)	,, *E.R.*	1·70	1·82	+ ·12	107	·26	18	17
Newcastle (Town Moor)	*North'land*	1·90	2·73	+ ·83	144	·68	18	16
Borrowdale (Seathwaite)	*Cumberland*	13·44	15·46	+2·02	116	2·95	20	14
Cardiff (Ely)	*Glamorgan*	3·65	4·78	+1·13	131	1·52	18	22
Haverfordwest	*Pembroke*	4·69	4·95	+ ·26	106	·72	17	20
Aberystwyth (Gogerddan)	*Cardigan*	3·91	3·16	— ·75	81	·83	18	16
Llandudno	*Carnarvon*	2·51	2·20	— ·31	88	·71	14	17
Cargen [Dumfries]	*Kirkcudbrt.*	4·10	5·93	+1·83	145	1·50	19	18
Marchmont House	*Berwick*	2·40	2·73	+ ·33	114	·59	19	14
Girvan (Pinmore)	*Ayr*	4·78	5·09	+ ·31	107	·50	9	25
Glasgow (Queen's Park)	*Renfrew*	3·53	4·09	+ ·56	116	1·75	20	15
Islay (Eallabus)	*Argyll*	4·78	4·18	— ·60	88	·49	19	27
Mull (Quinish)	,,	5·55	3·88	—1·67	70	·53	19	25
Balquhidder (Stronvar)	*Perth*	8·74	7·80	— ·94	89	1·87	29	22
Dundee (Eastern Necropolis)	*Forfar*	2·01	2·01	·00	100	·59	19	15
Braemar	*Aberdeen*	2·92	2·02	— ·90	69	·54	22	13
Aberdeen (Cranford)	,,	2·36	2·98	+ ·62	126	·71	22	20
Gordon Castle	*Moray*	1·99	3·21	+1·22	161	·42	22	20
Drumnadrochit	*Inverness*	3·63	3·84	+ ·21	106	·81	21	24
Fort William	,,	9·20	8·55	— ·65	93	2·16	28	26
Loch Torridon (Bendamph)	*Ross*	9·42	11·53	+2·11	122	1·01	28	26
Dunrobin Castle	*Sutherland*	2·75	3·24	+ ·49	118	·70	21	16
Killarney (District Asylum)	*Kerry*	5·94	9·51	+3·57	160	1·47	25	25
Waterford (Brook Lodge)	*Waterford*	3·78	3·87	+ ·09	103	·98	14	17
Nenagh (Castle Lough)	*Tipperary*	3·88	3·39	— ·49	87	·50	18	21
Ennistymon House	*Clare*	4·30	3·26	—1·04	76	·59	25	22
Gorey (Courtown House)	*Wexford*	3·19	4·34	+1·15	136	1·00	14	17
Abbey Leix (Blandsfort)	*Queen's Co.*	3·15	2·68	— ·47	85	·64	14	19
Dublin (Fitz William Square)	*Dublin*	2·14	1·60	— ·54	75	·35	18	15
Mullingar (Belvedere)	*Westmeath*	3·10	2·88	— ·22	93	·86	17	15
Crossmolina (Enniscoe)	*Mayo*	5·35	6·10	+ ·75	114	1·03	17	27
Cong (The Glebe)	,,	4·79	5·94	+1·15	124	1·38	17	23
Collooney (Markree Obsy.)	*Sligo*	3·87	4·57	+ ·70	118	1·10	17	26
Seaforde	*Down*	3·41	4·98	+1·57	146	1·05	19	21
Ballymena (Harryville)	*Antrim*	3·73	3·67	— ·06	98	·35	8	25
Omagh (Edenfel)	*Tyrone*	3·46	2·86	— ·60	83	·43	18	24

SUPPLEMENTARY RAINFALL, JANUARY, 1918.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road .	3·62	XI.	Lligwy	3·76
,,	Ramsgate.....	2·73	,,	Douglas, Isle of Man	.
,,	Hailsham	3·99	XII.	Stoneykirk, Ardwell House...	4·07
,,	Totland Bay, Aston House...	2·93	,,	Carsphairn, Shiel.....	11·01
,,	Stockbridge, Ashley..	3·75	,,	Langholm, Drove Road	6·81
,,	Grayshott.....	4·11	XIII.	Selkirk, The Hangingshaw..	3·80
III.	Harrow Weald, Hill House...	2·56	,,	North Berwick Reservoir.....	2·11
,,	Pitsford, Sedgebrook....	2·36	,,	Edinburgh, Royal Observaty.	2·03
,,	Woburn, Milton Bryant.....	3·29	XIV.	Biggar.....	2·37
,,	Chatteris, The Priory..... ...	1·84	,,	Maybole, Knockdon Farm ...	3·77
IV.	Elsenham, Gaunts End	2·91	XV.	Buchlyvie, The Manse.....	6·20
,,	Shoeburyness	2·74	,,	Ardgour House	12·97
,,	Colchester, Hill Ho., Lexden	2·56	,,	Oban.....	5·47
,,	Ipswich, Rookwood, Copdock	2·50	,,	Campbeltown, Witchburn ..	4·75
,,	Aylsham, Rippon Hall..... ..	2·02	,,	Holy Loch, Ardnadam.....	10·10
,,	Swaffham	2·46	,,	Tiree, Cornaigmore	2·53
V.	Bishops Cannings	3·14	XVI.	Glenquey	6·30
,,	Weymouth.....	3·18	,,	Glenlyon, Meggernie Castle..	...
,,	Ashburton, Druid House.. ..	6·86	,,	Blair Atholl	1·51
,,	Cullompton	5·44	,,	Coupar Angus	1·90
,,	Lynmouth, Rock House	5·78	,,	Montrose, Sunnyside Asylum.	2·02
,,	Okehampton, Oaklands.. ...	6·81	XVII.	Balmoral	3·18
,,	Hartland Abbey.....	4·85	,,	Fyvie Castle	5·01
,,	St. Austell, Trevarna	4·97	,,	Keith Station	4·29
,,	North Cadbury Rectory.....	3·30	XVIII.	Rothiemurchus	2·57
VI.	Clifton, Stoke Bishop	3·63	,,	Loch Quoich, Loan	13·30
,,	Ledbury, Underdown..... ...	2·42	,,	Skye, Dunvegan	7·20
,,	Shifnal, Hatton Grange.....	1·77	,,	Fortrose.....	3·28
,,	Droitwich.....	2·22	,,	Glencarron Lodge	7·08
,,	Blockley, Upton Wold.....	3·18	XIX.	Tongue Manse	4·17
VII.	Grantham, Saltersford.....	1·52	,,	Melvich	3·35
,,	Market Rasen	1·66	,,	Loch More, Achfary	6·95
,,	Bawtry, Hesley Hall	1·22	XX.	Dunmanway, The Rectory ..	7·76
,,	Whaley Bridge, Mosley Hall	3·16	,,	Glanmire, Lota Lodge.....	4·70
,,	Derby, Midland Railway.....	1·70	,,	Mitchelstown Castle	4·33
VIII.	Nantwich, Dorfold Hall	1·86	,,	Darrynane Abbey.....	6·08
,,	Bolton, Queen's Park	3·72	,,	Clonmel, Bruce Villa	3·66
,,	Lancaster, Strathspey	4·14	,,	Broadford, Hurdlestown.....	3·62
IX.	Langsett Moor, Up. Midhope	3·11	XXI.	Enniscorthy, Ballyhyland...	3·55
,,	Scarborough, Scalby	2·27	,,	Rathnew, Clonmannon	3·73
,,	Ingleby Greenhow	1·89	,,	Ballycumber, Moorock Lodge	2·12
,,	Mickleton	3·90	,,	Balbriggan, Ardgillan	2·65
X.	Bellingham, High Green Manor	4·08	,,	Castle Forbes Gardens.....	3·38
,,	Ilderton, Lilburn Cottage ...	2·76	XXII.	Ballynahinch Castle.....	6·34
,,	Keswick, The Bank.....	7·05	,,	Woodlawn	2·40
XI.	Llanfrechfa Grange	4·24	,,	Westport, St. Helens...	5·05
,,	Treherbert, Tyn-y-waun	8·73	,,	Dugort, Slievemore Hotel ...	5·13
,,	Carmarthen, The Friary	5·60	XXIII.	Enniskillen, Portora.....	4·14
,,	Fishguard, Goodwick Station.	4·50	,,	Dartrey [Cootehill]	3·19
,,	Crickhowell, Tal-y-maes.....	4·50	,,	Warrenpoint, Manor House ..	3·12
,,	New Radnor, Ednol	2·60	,,	Belfast, Cave Hill Road	4·72
,,	Birmingham WW., Tyrmynydd	6·18	,,	Glenarm Castle	3·85
,,	Lake Vyrnwy	5·28	,,	Londonderry, Creggan Res...	3·19
,,	Llangynhafal, Plas Drâw.....	1·99	,,	Dunfanaghy, Horn Head ...	...
,,	Dolgelly, Bryntirion.....	4·72	,,	Killybegs	4·07
,,	Bettws-y-Coed, Tyn-y-bryn...	...			

Climatological Table for the British Empire, August, 1917.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain Depth.	Total Rain Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	80·5	22	49·6	20	71·4	55·6	55·8	83	131·3	47·6	3·99	23	7·3
Malta	93·6	30	69·5	12	87·0	74·5	...	74	143·0	...	·00	0	0·5
Lagos	89·0	1	70·5	3	82·5	72·9	73·1	86	147·2	69·0	22·77	28	9·0
Cape Town	72.4	18	38·4	26	62·4	46·6	45·9	73	...	...	2·15	13	5·3
Johannesburg	68·5	6	28·6	9	58·7	39·6	36·0	73	...	30·1	2·57	10	3·2
Mauritius	76·3	29	54·0	22	74·0	61·6	58·5	75	...	·96	2·60	24	6·4
Bloemfontein	74·7	4	24·1	3	60·4	34·9	34·7	70	..	...	1·96	10	4·5
Calcutta...	91·7	22	75·6	13	87·8	78·7	77·7	86	...	74·1	14·27	18	8·9
Bombay...	87·7	18	73·4	15	83·6	77·1	76·4	88	133·5	71·1	33·27	28	9·0
Madras	98·3	2	73·7	29	92·1	77·1	74·5	79	161·5	73·1	6·39	18	6·1
Colombo, Ceylon	87·8	2	73·7	26	85·4	76·9	73·0	80	153·2	68·0	2·28	14	7·9
Hongkong	90·5	29	74·4	14	87·2	76·3	76·2	83	...	...	11·95	14	5·5
Sydney	70·2	30	40·1	2	62·0	46·8	42·7	69	119·2	29·2	2·04	11	3·2
Melbourne	67·6	28	33·0	5	59·2	44·6	43·3	68	115·6	25·9	2·25	13	5·5
Adelaide	74·3	9, 17	37·7	26	62·0	45·6	44·9	70	127·9	28·1	3·04	14	4·9
Perth	73·6	25	36·3	10	62·3	46·6	45·9	70	131·2	31·4	4·56	14	5·3
Coolgardie	77·2	27	31·8	18	63·0	41·0	35·8	51	135·3	27·0	·63	6	3·6
Hobart, Tasmania ..	64·0	10	35·8	6	56·9	41·9	39·0	64	113·4	29·2	2·30	15	5·5
Wellington	60·3	25	34·4	21*	55·4	43·9	43·4	79	122·5	25·0	3·94	15	5·5
Auckland	...	...	...	...	...	...	...	...	...	...	...	...	...
Jamaica, Kingston ..	91·8	25	70·5	25	89·7	73·3	71·2	80	...	...	1·15	6	5·2
Grenada	89·0	30	71·0	5, 24	85·0	75·0	...	78	138·0	...	10·58	23	4·0
Toronto	92·0	1	46·0	31	77·7	57·7	58·7	81	141·8	40·2	4·44	12	5·8
Fredericton	91·0	2	44·0	27	78·1	56·7	61·1	83	...	...	7·20	13	5·7
St. John, N.B.	84·0	7	50·0	27	70·5	55·9	58·0	85	141·2	45·9	4·34	16	6·4
Victoria, B.C.	82·0	31	49·0	5, 8	69·2	51·6	52·0	76	134·8	39·0	·19	1	1·9

* And 27.

Johannesburg.—Bright sunshine 258·°0 hours.

COLOMBO, CEYLON.—Mean temp. 81°·1, same as average, dew point 0°·6 below, average and R ·40 in. below average. Mean hourly velocity of wind 5·6 miles.

HONGKONG.—Mean temp. 82°·0. Bright sunshine 239·6 hours. Mean hourly velocity of wind 7·4 miles.

Melbourne.—Mean temp. 0°·8 above, and R ·45 in. above, averages. A remarkable meteoric display on the 20th. Fine aurora australis on the 9th at 7 p.m.

Adelaide.—Mean temp. 0°·1 below, and R ·54 in. above, averages.

Coolgardie.—Temp. 1°·7 below average.

Hobart.—Magnificent aurora australis on the 9th.

Wellington.—Mean temp. 1°·2 above and rainfall ·56 in. below averages. Bright sunshine 148·1 hours. Frost on 10 days. Cloudy and showery month.

UNIV. OF CALIFORNIA

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THE SHOWER CLOUD BLACK LINES.

By L. C. W. Bonacina.

All who study the clouds from either the artistic or scientific point of view, or from both, as everyone should, must be familiar with the characteristic dark stripes or streaks which appear beneath detached cloud-masses from which rain is falling. To the shepherd on the solitary hills, accustomed to take long-range views, the phenomenon, indeed, must be as familiar as any in the skies; but it can scarcely be less famliar among the ordinary phenomena of nature to any one who lives in the more open districts of London, and who examines the sky for other sights than air-craft. The appearance is most sharply defined in the case of clouds nearer the horizon than the zenith, and it is essentially characteristic of broken showery conditions of weather. It is not conspicuous against the uniform grey sky of a set-in wet day, for the reason, apparently, that on an overcast day there is not the contrast between light and shadow which is necessary in order that the raindrops may be sharply silhouetted against the background of the sky. But on a showery day with varied skies the drops may be shown up in the manner described either against the background of the cloud from which they are falling, or against clear sky appearing beneath the cloud. It is not a little surprising that a phenomenon so common in this showery climate should be so seldom referred to in literature—the more so on account of its utility as an index of falling rain at a distance.

There are a number of cloudy days in the year when it is very difficult from an inspection of the sky to tell definitely whether the tendency is showery or not. But if in any quarter of the sky you see a cloud from whose base these black lines are pendent you may say at once: "Rain is falling from that cloud"—which means, of course, that showers are about, and that it is highly probable you will experience one locally before the day is over. The association of these black lines with showery conditions is invariable, and that they are falling rain-drops shown up against the background of the sky cannot be doubted.

ROYAL METEOROLOGICAL SOCIETY.

THE annual general meeting of this Society was held on Wednesday, 16th instant, at Caxton Hall, Westminster, Major H. G. Lyons, F.R.S., President, in the Chair.

The Report of the Council for 1917 was read, and the Symons Memorial Medal, which is awarded biennially for distinguished work in connection with Meteorological Science, was presented to Dr. H. R. Mill, Director, British Rainfall Organization. The following officers were elected for the ensuing session :—*President*—Sir Napier Shaw, F.R.S. ; *Vice-Presidents*—Mr. T. W. Backhouse, Major Lyons, F.R.S., Mr. Henry Mellish, C.B., Captain A. J. Walker ; *Treasurer*—Mr. Francis Druce ; *Secretaries*—Mr. W. W. Bryant, Mr. W. Vaux Graham, M.Inst.C.E. ; *Foreign Secretary*—Mr. R. G. K. Lempfert, C.B.E. ; *Councillors*—Mr. C. E. P. Brooks, Prof. C. M. Delgado de Carvalho, Captain C. J. P. Cave, R.E., Mr. J. Edmund Clark, Mr. J. S. Dines, Mr. W. H. Dines, F.R.S., Captain G. M. B. Dobson, Mr. R. H. Hooker, Mr. Carle Salter, Major G. I. Taylor, R.F.C., Prof. H. H. Turner, F.R.S., Mr. F. J. W, Whipple.

Major H. G. Lyons delivered an address on " The Meteorological Resources of the Empire," in the course of which he remarked that in many directions steps are being taken to take stock of the resources of the Empire, and to plan how these may best be utilized in the general reconstruction which must undoubtedly be taken in hand on the cessation of hostilities. In meteorology the same should be done, for within the Empire we may meet every type of climate. The great Oversea Dominions, India, the colonies and especially the oceanic islands, not only afford the means for extending our knowledge of the direction and velocity of the currents of the upper air, to meet the demands of aviation, which will become greater in the near future, but with a very moderate increase in the resources of their existing institutions, and more active co-operation, they may powerfully aid in the solution of many meteorological problems of theoretical and practical importance.

In all countries where there is a meteorological service the network of climatological stations is controlled by one or more First Order Stations, but none as yet exist in the great colonial regions of East Africa, West Africa, or in the West Indian Islands, though there are eighteen institutions of this class in other parts of the Empire.

Nor is the study of a single region sufficient in itself. India, in preparing the Monsoon forecast, draws upon data from Egypt, St. Helena, temperate South America, etc. ; Egypt, in forming each year an estimate of the coming Nile flood utilizes information from India, Uganda, the South Atlantic, and so on. The West India

Islands need warnings of their hurricanes from the more eastward islands of their archipelago, and must utilize all that Asia and Africa can tell them about the development and movement of tropical storms before their precautions can be considered to have exhausted all the means available. All lands which lie near the sub-tropical zones of scanty rainfall are vitally interested in the problems of forecasting the probable sufficiency or failure of their rainy season. Within the limits of the Empire there are already over 1,000 climatological stations, ranging in latitude from 66° N. to 54° S. and embracing all varieties of climate, insular, continental and mountain.

The Address concluded with a plea for the more efficient organization of the available meteorological resources of the Empire, and a hope was expressed that a career might be available for some of the large number of trained meteorologists whom present needs had created.

At the conclusion of the meeting Sir Napier Shaw, F.R.S., took over the duties of President.

The following gentlemen were elected fellows :—Dr. Thomas Agius, Capt. H. Bathurst, Mr. F. L. Bland, Mr. L. C. W. Bonacina, Major J. Shipley Ellis, Rev. W F. A. Ellison, M.A., Mr. F. J. Gurney, Mr. A. J. Kelley, Mr. Elliott Kitchener, Mr. W. D. Lewis, Mr., H. Lowery, Capt. S. W. Price-Williams, Mr. J. Sherwen.

THE usual monthly meeting of this Society was held on February 20th, Sir Napier Shaw, F.R.S., President, in the Chair.

A paper by Mr. F. A. Bellamy, on "The Barometer Record at the Radcliffe Observatory, Oxford, with special reference to Professor Turner's suggested discontinuities," was read. Professor Turner has in several papers to the Royal Meteorological Society claimed that meteorological history is divisible into "chapters" of an average length of six and a half years each, and has assigned the dates at which a new "chapter" opens (when there are abrupt discontinuities in meteorological phenomena) with considerable precision for the last two centuries. The evidence has hitherto been based upon the monthly values of rainfall and temperature, and he has shown that these monthly values differ systematically in the "even" chapters as compared with the "odd." To examine whether such systematic differences extended to periods shorter than one month Mr. Bellamy has analysed a series of 62 years daily barometer records. He collected all those records into daily groups and formed the means of the differences between "even and odd chapters" for corresponding days; these were in many cases

quite large, but apparently no larger than similar arbitrary differences for any chance selection of years that was made. Only one such arbitrary selection was used for comparison, but it is probably sufficient to substantiate that statement. Proceeding now to combine two consecutive days together, then three such days and so on in groups of 6 up to 180 days, Mr. Bellamy found that the differences between corresponding groups of even minus odd still remained "accidental" in character until the number of days combined reached about 30; but from this point the even minus odd set began to show an excess which gradually increased until the differences became twice as great. The inference is that for periods from one to six months there is a decided difference in the even and odd chapters for atmospheric pressure, even for one station, as has been shown for rainfall and temperature from many stations, and that the existence of discontinuities is supported.

Dr. C. Chree, F.R.S., read a paper entitled "The Diurnal Variation of Barometric Pressure at Seven British Observatories, 1871–1882." The diurnal variation of atmospheric pressure, as of any other element, can be analysed in Fourier terms or "waves," of periods 24, 12, 8 hours. In the case of the mean diurnal variation from all months of the year combined, the 12-hour wave appears of a very dominant character, the amplitude being nearly the same for all stations in the same latitude, and the phase referred to local mean time being everywhere nearly the same. The 24-hour wave on the other hand is very variable and the 8-hour wave small compared with the 12-hour wave. Taking the seven stations, Valencia, Armagh, Glasgow, Aberdeen, Stonyhurst, Falmouth and Kew, it is pointed out that the comparative unimportance of the 8-hour wave in the mean diurnal inequality for the year arises in great measure from the large difference that presents itself between the phase angles in two different seasons of the year. In individual months the 8-hour wave, though considerably smaller than the 12-hour wave, is far from negligible, and the phenomena presented by the 8-hour wave at the seven British stations exhibit almost as close a similarity as those presented by the 12-hour wave. The paper also considered a theory as to the nature of the 12-hour wave recently advanced by Dr. G. C. Simpson. It discussed the theory from the point of view of the variation in the phenomena throughout the year, and showed how some of Dr. Simpson's mathematical expressions can be put in a simpler form of sufficient accuracy in the case of stations in low or middle latitudes.

The following candidates were elected Fellows of the Society :— Mr. Harry Lander, Mr. Edgar Lyman, Mrs. H. Edith Purchas.

SCOTTISH METEOROLOGICAL SOCIETY.

In a paper on "Some cases of Ground-ice and the meteorological conditions that determined them," read on December 20th, at the Annual General Meeting of the Society, Mr. Watt noted that towards the end of January, 1917, various water-supply systems were seriously affected by the formation of "ground-ice," though interruptions from that cause had not previously been experienced even during longer and more severe spells of cold. Occurrences at some of the Greenock reservoirs and at Lochrutton Loch, near Dumfries, had been especially noteworthy. The weather had been for some three weeks before not only very cold but continously rather stormy, with north-easterly winds, so that there had been an unusually thorough mixing of the waters of lakes and reservoirs, comparable with that obtaining in running waters. In these circumstances there would be a quite unusual cooling of the whole mass of water, whilst waves or wavelets prevented the formation of a protective surface ice-sheet. In comparatively quiet anticyclonic weather, such as characterised a frost such as that of January and February, 1895, "ground-ice" formed only in running streams. The researches some eighty years ago of the Rev. James Farquharson, F.R.S., of Alford, seemed to indicate that radiation from the floor of a stream was the determining factor in the formation of "ground-ice." There was also "Frazil-ice," which appeared in the form of little spicules on the surface of running water.

Dr. John Aitken, F.R.S., in a paper on "Ground-ice," communicated the results of some experiments which showed that "Ground-ice" was really made up of crystals of "Frazil-ice" which had been carried away by the stream and had come in contact with and adhered to the stones and rocks in the bed of the stream. Farquharson's radiation theory could hardly be a sufficient explanation of the formation of "Ground-ice" as water must be cooled some degrees below 32° F. before it can freeze, unless there be ice present, and the bottom of a river was never likely to be cooled much below 32° F. with water flowing over it. Moreover, "Ground-ice" was of a soft and spongy character and not clear and solid as it would have been if formed *in situ*. The spicules of "Frazil-ice" might or might not adhere to obstacles in the stream and the part played by radiation from the river bed seemed to be to help to cool the stones and rocks sufficiently to prevent the spicules slipping when they came in contact with them. If the temperature of the water was rising and the ice beginning to melt, the ice slipped over an obstacle, but with a falling temperature it adhered to it.

NOTE!—Summer Time commences Sunday, 24th March.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

COLD DECEMBER DAYS IN AMERICA.

DECEMBER, 1917, was one of the most remarkable months in meteorological records in the eastern section of the United States. During the last three days of the year intensely cold weather prevailed. Subjoined are temperatures for the three days at Philadephia :—

	Max.	Min.	Mean.	Below Normal.
	°	°	°	°
Dec. 29th	10	2	6	27
,, 30th	8	−4	2	31
,, 31st	11	0	5	28

These are from standard thermometers exposed in a weather bureau instrument shelter. The high barometer that dominated the weather was above thirty-one inches over the north-west.

C. DECKER.

2330 S. 21st Street, Philadelphia, U.S.A.

THE RAINFALL OF HAVANA AND ENGLAND, SOUTH-WEST.

THE rainfall data for Havana, Cuba, for the rainy season May-October, 1917, have now been received. The figures show only 57 per cent. of the average fall for these months, and, with one exception, the rainfall at Havana during the wet season has been deficient each year since 1911.

Previous notes have shown the connection between the rainfall at Havana during May-October, and the subsequent amount registered in England, South-west, during January-March following. the correlation co-efficient being —·54 and the probable error ·08

The rainfall of Havana for 1917 being so much below the average suggests copious precipitation in England, South-west, during January-March of the present year, but in 1916 the Havana figures also indicated a similar result and the amount recorded was only 69 per cent. of the average. In view of the complete failure of last year's indication faith in the correlated connection between the two districts is distinctly shaken, and it will be interesting to see if last year was the exception that proves the rule. Perhaps the believers in the rain-producing effect of gun-fire will urge that the heavy precipitation normal to the western districts of this country has been diverted to the eastern counties ?

January 7th, 1918. A. HAMPTON BROWN.

THE SQUALL OF NOVEMBER 25th, 1917.

WHEN I wrote on this subject in the last number I had not examined the instrumental records for the London district, and from casual eye observation was under the impression that the squall took place in a cold N.W. current of more or less uniform temperature. But through the kindness of Mr. Bryant of Greenwich Observatory I have obtained sufficient instrumental information to show that the squall was marked by a sudden shift of wind to a still colder quarter, and that it can, therefore, be easily enough explained in the ordinary way.

There were in fact two squalls that morning. The first passed over Greenwich soon after 4 a.m., with a shift of wind from W.S.W. to W.N.W., and sudden drop of temperature. The second (which caught me whilst out at Hampstead) passed over Greenwich about 11.30 a.m., with wind-shift from W.N.W. to N.N.W. and greater fall in temperature than on the first occasion. Hence there was a succession of cold "douches" from more northerly points of the compass, and I have little doubt that cartographic investigation for the morning in question would confirm the passage across the country of minor line-squalls in connection with the juxta-position of air currents of different temperatures. Out walking I was not sufficiently alert to notice that the wind had shifted a couple of points, and, of course, temperature changes cannot be accurately judged.

L. C. W. BONACINA.

February 3rd, 1918.

WARM FEBRUARY.

DURING my readings of temperature here only four times in the past thirty-two years has the February mean maximum been higher than that of February, 1918. Only once has the mean minimum of February been higher than that of February, 1918, and only twice has the maximum and minimum combined been higher than that of February, 1918. The following table gives the data for the years referred to :—

		Max.	Min.	Mean.
February,	1899 ...	48·4 ...	37·7 ...	43·1
	1903 ...	48·1 ...	40·5 ...	44·3
	1910 ...	47·8 ...	39·0 ...	43·4
	1914 ...	48·6 ...	41·4 ...	45·0
	1918 ...	47·4 ...	40·7 ...	44·0

JOHN DOVER.

Totland Bay, Isle of Wight, 1st March, 1918.

EXCEPTIONAL DRYNESS OF NOVEMBER AND DECEMBER—A COMPARISON.

THE rainfall for November and December has been so exceptionally small for that period that I think the figures are sufficiently interesting to quote, therefore I give below a table of the rainfall for November and December of each year since 1911 :—

	No. of Wet		No. of Wet		No. of Wet		No. of Wet		No. of Wet		No. of Wet	
1911.	days.	1912.	days.	1913.	days.	1914.	days.	1915.	days.	1916.	days.	1917.	days
Nov.													
5·05	19	2·37	17	3·38	18	4·60	19	3·59	8	4·50	20	1·00	11
Dec.													
8·69	27	4·62	23	2·04	12	10·46	26	9·52	25	4·39	18	1·08	8
13·74	46	6·99	40	5·42	30	15·06	45	13·11	33	8·89	38	2·08	19

The scanty rainfall during the past two months is undoubtedly due to the prevalence of N.W.-N.E. winds which have been particularly common lately. S. HYLA GREVES.

Rodney House, Bournemouth, January 4th, 1918.

REMARKABLE LOWNESS OF STREAMS IN DEVON.

ALTHOUGH we had anything but a fine summer and have had no absolute or partial droughts, yet streams in this neighbourhood are lower than they have been for years. This substantiates the fact that summer rains do not affect springs as winter rains or snow do, as in this locality, although last winter was severe, there was very little snow, and this winter seems likely to follow suit, the heavy snowfalls in the eastern and midland counties not reaching this part of England. D. W. HORNER, F.R.Met.Soc.

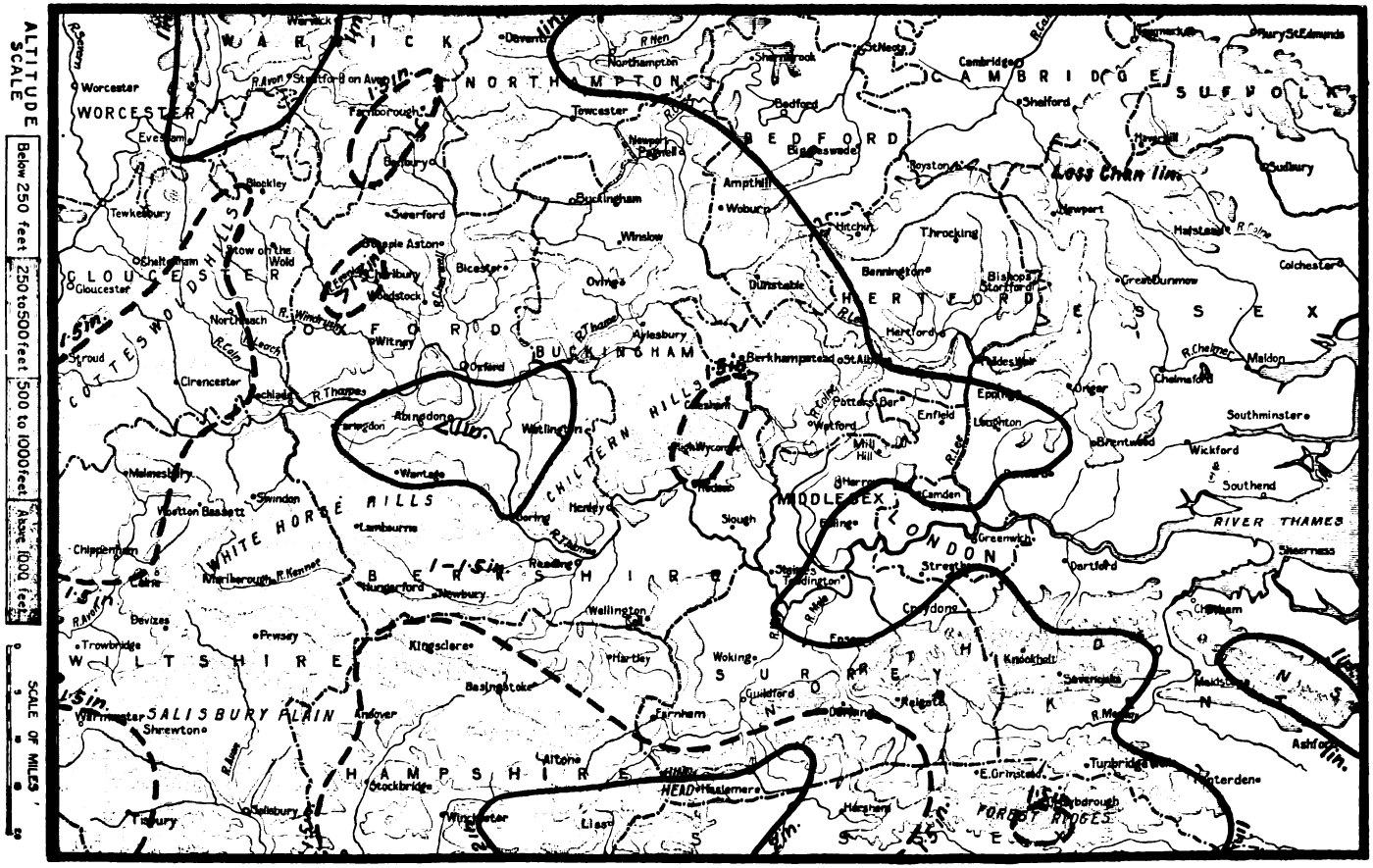
Moretonhampstead, January 4th, 1918.

PROTECTIVE POWER OF SNOW.

THE following observation shows the remarkable extent to which a covering of snow protects the ground and plant life from intense cold. About 6 p.m. on the 13th January, a minimum thermometer was placed on the ground in the centre of my lawn here, the temperature then being only a few degrees below freezing. Snow then fell to the depth of one and a half inches. At 11 p.m. the snow had ceased falling and it was a bright starlight night, and very cold. A second minimum thermometer was then placed on the top of the snow. No more snow fell in the night. In the morning the two thermometers recorded the following minimum temperatures :— On the top of the snow, 2° below zero ; under the snow, 24°, or a difference of 26°. A. R. CROSSLEY.

Falling Royd, Hebden Bridge, 2nd February, 1918.

THAMES VALLEY RAINFALL FEBRUARY, 1918.



Symons's Meteorological Magazine

Watershed of River Thames above Teddington and River Lee above Feildes Weir

THE WEATHER OF FEBRUARY.

By F. J. Brodie.

Owing to prevalence of wind from south and west the mean temperature was considerably above the average, both in the daytime and at night.

During the first week the British Isles lay between a large anticyclone over central Europe and a series of depressions moving northwards along our Atlantic seaboard. Southerly winds prevailed generally, and the weather was mild and changeable, maximum temperatures slightly above 55° being recorded on the 4th and again on the 7th in several parts of England. After about the 5th the anticyclone drifted slowly southwards to the Mediterranean. This change was accompanied in our islands by a gradual veering of the wind, first to S.W., and afterwards to W., but temperature remained high, the maximum readings of the 10th-12th being again above 55° at many stations in England and Ireland. The Atlantic depressions pursued in the meantime, an easterly course, between Iceland and Scotland, and the wind on our western and northern coasts occasionally rose to the force of a gale. On the 12th and 13th the weather became dull and gloomy and fog prevailed extensively over our eastern districts. After the 13th a new anticyclone extended westward over Great Britain, a light breeze from S. and S.E. set in, and temperature fell decidedly. Between the 14th and 17th sharp night frosts were in fact experienced, the temperature falling to 20° in the east centre and south of England, while the grass temperature reached 9° on the 17th at Wisley, and at Raunds. After the 17th a high-pressure system extended northwards from the Azores region, and between the 20th and 26th, when depressions passed from Greenland to Scandinavia, a mild westerly breeze of increasing strength set in over our islands, and temperature again rose considerably above the average. The warmest weather occurred on the 22nd or 23rd, reaching 60° at Geldeston, and 61° at Aberdeen, the latter a reading exceeded once only at Aberdeen during 50 years, 64° having been observed on the 22nd of the month in 1897.

On the 27th, in the rear of one of the northern disturbances, a secondary depression was developed near the Faeroe, and on the following day, when this system moved southwards over the North Sea, a northerly gale sprang up over nearly the whole of the United Kingdom, and blew with great strength on our north and north-west coats. At Holyhead the wind reached, in gusts, a velocity of 72 miles, and at Aberdeen, 74 miles per hour. Snow fell heavily in the north, and sleet or hail in all other districts, and on the 28th the thermometer in many places failed to reach a maximum of 40°.

Over the United Kingdom as a whole the total duration of bright sunshine in February was below the normal, and in the west little more than one half. In the London district, the average was slightly exceeded. At Kew the duration for December to February was 178 hours, being 37 more than the average.

The only part of the British Isles with appreciably less than the average rainfall was in the south of England, and in the extreme south-east little more than half the average fell, less than 1·00 in. being recorded from Cromer to Beachy Head. The fall increased towards the west, and exceeded 5 inches over all elevated regions, except in Devonshire, and 10 inches over considerable areas in Wales and Scotland. Nearly twice the average fell in the West Highlands and in the north of Ireland. The general rainfall expressed as a percentage of the average, was :—England and Wales, 107, Scotland, 159, Ireland, 166, British Isles, 140 per cent.

In London (Camden Square), the mean temperature was 43°·4, or 3°·7 above the average. The duration of bright sunshine was 38·9 hours, and the duration of rainfall, 25·3 hours. Evaporation, ·27 in.

RAINFALL TABLE FOR FEBRUARY, 1918.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875–1909. in.	1918. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	1·66	1·11	— ·55	67	·25	24	16
Tenterden	*Kent*	1·90	·89	—1·01	47	·21	24	14
Arundel (Patching)	*Sussex*	2·17	1·10	—1·07	51	·24	24	11
Fordingbridge (Oaklands)	*Hampshire*	2·34	1·99	— ·35	85	·35	8	18
Oxford (Magdalen College)	*Oxfordshire*	1·62	1·00	— ·62	62	·15	5	12
Wellingborough (Swanspool)	*Northampn*	1·70	1·12	— ·58	66	·18	2,6	15
Bury St. Edmunds (Westley)	*Suffolk*	1·59	·92	— ·67	58	·20	12	11
Geldeston [Beccles]	*Norfolk*	1·41	·75	— ·66	53	·13	24	13
Polapit Tamar [Launceston]	*Devon*	2·95	2·82	— ·13	96	·38	2	19
Rousdon [Lyme Regis]	,,	2·50	1·71	— ·79	68	·36	8	16
Stroud (Field Place)	*Gloucester*	2·12	1·48	— ·64	70	·24	24	16
Church Stretton	*Shropshire*	...	2·33	...	...	·59	9	17
Boston	*Lincoln*	1·53	1·57	+ ·04	103	·47	9	18
Worksop (Hodsock Priory)	*Nottingham*	1·64	1·35	— ·29	82	·30	9	16
Mickleover Manor	*Derbyshire*	1·71	1·98	+ ·27	116	·57	10	17
Buxton	,,	4·01	5·96	+1·95	149	1·24	6	21
Southport (Hesketh Park)	*Lancashire*	2·07	2·89	+ ·82	140	·56	20	18
Arncliffe Vicarage	*York, W.R.*	4·88	6·75	+1·87	138	...	...	...
Wetherby (Ribston Hall)	,, ,,	1·71	2·64	+ ·93	154	·53	9	14
Hull (Pearson Park)	,, *E.R.*	1·78	1·66	— ·12	93	·33	9	17
Newcastle (Town Moor)	*North'land*	1·63	1·26	— ·37	77	·20	20	14
Borrowdale (Seathwaite)	*Cumberland*	10·96	20·56	+9·60	187	4·45	21	25
Cardiff (Ely)	*Glamorgan*	3·07	2·04	—1·03	66	·27	2	22
Haverfordwest	*Pembroke*	3·42	2·98	— ·44	87	·78	6	20
Aberystwyth (Gogerddan)	*Cardigan*	3·09	4·17	+1·08	135	·83	6	21
Llandudno	*Carnarvon*	2·11	2·74	+ ·63	130	·69	6	20
Cargen [Dumfries]	*Kirkcudbrt.*	3·42	5·56	+2·14	163	·73	10	25
Marchmont House	*Berwick*	2·15	2·31	+ ·16	107	·33	28	19
Girvan (Pinmore)	*Ayr*	3·87	6·37	+2·50	165	·98	17	25
Glasgow (Queen's Park)	*Renfrew*	2·70	4·71	+2·01	174	·74	22	24
Islay (Eallabus)	*Argyll*	3·91	6·20	+2·29	159	1·08	18	25
Mull (Quinish)	,,	4·45	9·32	+4·87	209	1·14	17	26
Balquhidder (Stronvar)	*Perth*	6·33	13·13	+6·80	207	1·96	21	25
Dundee (Eastern Necropolis)	*Forfar*	1·91	1·95	+ ·04	102	·35	27	22
Braemar	*Aberdeen*	2·55	4·20	+1·65	165	·80	27	21
Aberdeen (Cranford)	,,	2·36	1·39	— ·97	59	·32	12	13
Gordon Castle	*Moray*	1·95	1·58	— ·37	81	·28	27	14
Drumnadrochit	*Inverness*	2·89	4·22	+1·33	146	·57	21	25
Fort William	,,	6·85	13·14	+6·29	192	1·48	23	26
Loch Torridon (Bendamph)	*Ross*	7·53	14·19	+6·66	188	1·19	17	27
Dunrobin Castle	*Sutherland*	2·58	3·00	+ ·42	116	·57	24	16
Killarney (District Asylum)	*Kerry*	4·99	7·47	+2·48	150	·94	18	26
Waterford (Brook Lodge)	*Waterford*	3·18	3·83	+ ·65	120	·44	1	23
Nenagh (Castle Lough)	*Tipperary*	2·89	5·72	+2·83	198	·95	18	24
Ennistymon House	*Clare*	3·44	4·74	+1·30	138	·58	17	23
Gorey (Courtown House)	*Wexford*	2·75	3·50	+ ·75	127	·63	16	23
Abbey Leix (Blandsfort)	*Queen's Co.*	2·55	4·70	+2·15	184	·74	18	23
Dublin (Fitz William Square)	*Dublin*	1·93	1·90	— ·03	98	·29	17	21
Mullingar (Belvedere)	*Westmeath*	2·67	4·04	+1·37	151	·67	11	23
Crossmolina (Enniscoe)	*Mayo*	4·20	7·10	+2·90	169	1·04	17	26
Cong (The Glebe)	,,	3·72	6·74	+3·02	181	1·17	17	25
Collooney (Markree Obsy.)	*Sligo*	3·20	6·17	+2·97	193	·73	17	26
Seaforde	*Down*	2·81	4·49	+1·68	160	·76	18	23
Ballymena (Harryville)	*Antrim*	2·99	5·36	+2·37	179	1·31	18	24
Omagh (Edenfel)	*Tyrone*	2·68	5·13	+2·45	191	·75	18	26

SUPPLEMENTARY RAINFALL, FEBRUARY, 1918.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	1·76	XI.	Lligwy	3·36
,,	Ramsgate.....	·61	,,	Douglas, Isle of Man	5·12
,,	Hailsham	1·19	XII.	Stoneykirk, Ardwell House...	3·92
,,	Totland Bay, Aston House...	1·17	,,	Carsphairn, Shiel.....	11·39
,,	Stockbridge, Ashley..	1·63	,,	Langholm, Drove Road	6·25
,,	Grayshott.....	2·21	XIII.	Selkirk, The Hangingshaw..	2·59
III.	Harrow Weald, Hill House...	1·21	,,	North Berwick Reservoir.....	2·46
,,	Pitsford, Sedgebrook.....	1·02	,,	Edinburgh, Royal Observaty.	2·47
,,	Woburn, Milton Bryant.....	·97	XIV.	Biggar.....	4·62
,,	Chatteris, The Priory.....	·92	,,	Maybole, Knockdon Farm ...	5·10
IV.	Elsenham, Gaunts End	·82	XV.	Buchlyvie, The Manse.....	7·46
,,	Shoeburyness	·71	,,	Ardgour House	14·21
,,	Colchester, Hill Ho., Lexden	·52	,,	Oban.....	6·83
,,	Ipswich, Rookwood, Copdock	·65	,,	Campbeltown, Witchburn ..	6·34
,,	Aylsham, Rippon Hall.... ..	1·19	,,	Holy Loch, Ardnadam.....	13·03
,,	Swaffham	1·08	,,	Tiree, Cornaigmore	...
V.	Bishops Cannings	1·29	XVI.	Glenquey	8·50
,,	Weymouth.....	1·35	,,	Glenlyon, Meggernie Castle..	...
,,	Ashburton, Druid House.....	3·48	,,	Blair Atholl	4·24
,,	Cullompton	1·82	,,	Coupar Angus	2·26
,,	Lynmouth, Rock House	3·15	,,	Montrose, Sunnyside Asylum.	1·75
,,	Okehampton, Oaklands... ...	3·62	XVII.	Balmoral	2·74
,,	Hartland Abbey.....	2·35	,,	Fyvie Castle	1·16
,,	St. Austell, Trevarna	3·61	,,	Keith Station	1·72
,,	North Cadbury Rectory.....	1·10	XVIII.	Rothiemurchus	3·32
VI.	Clifton, Stoke Bishop	2·32	,,	Loch Quoich, Loan	31·40
,,	Ledbury, Underdown..... ...	·93	,,	Skye, Dunvegan	11·26
,,	Shifnal, Hatton Grange.....	1·50	,,	Fortrose.....	2·38
,,	Droitwich.....	1·35	,,	Glencarron Lodge	11·09
,,	Blockley, Upton Wold.....	1·57	XIX.	Tongue Manse	2·86
VII.	Grantham, Saltersford.....	1·58	,,	Melvich	2·94
,,	Market Rasen	1·72	,,	Loch More, Achfary	7·39
,,	Bawtry, Hesley Hall	1·43	XX.	Dunmanway, The Rectory ..	8·79
,,	Whaley Bridge, Mosley Hall	5·48	,,	Glanmire, Lota Lodge.....	6·55
,,	Derby, Midland Railway.....	1·99	,,	Mitchelstown Castle.....	6·04
VIII.	Nantwich, Dorfold Hall	2·39	,,	Darrynane Abbey.....	5·76
,,	Bolton, Queen's Park	4·71	,,	Clonmel, Bruce Villa	5·31
,,	Lancaster, Strathspey	4·25	,,	Broadford, Hurdlestown.....	5·22
IX.	Langsett Moor, Up. Midhope	4·64	XXI.	Enniscorthy, Ballyhyland...	4·54
,,	Scarborough, Scalby	2·10	,,	Rathnew, Clonmannon	3·48
,,	Ingleby Greenhow	1·31	,,	Ballycumber, Moorock Lodge	3·58
,,	Mickleton	5·60	,,	Balbriggan, Ardgillan	2·97
X.	Bellingham, High Green Manor	2·69	,,	Castle Forbes Gardens.....	4·22
,,	Ilderton, Lilburn Cottage ...	1·06	XXII.	Ballynahinch Castle.....	7·43
,,	Keswick, The Bank.....	8·30	,,	Woodlawn	3·38
XI.	Llanfrechfa Grange	2·85	,,	Westport, St. Helens	2·99
,,	Treherbert, Tyn-y-waun	9·47	,,	Dugort, Slievemore Hotel ...	8·10
,,	Carmarthen, The Friary	3·48	XXIII.	Enniskillen, Portora.....	4·86
,,	Fishguard, Goodwick Station.	2·93	,,	Dartrey [Cootehill]	3·84
,,	Crickhowell, Tal-y-maes.....	2·20	,,	Warrenpoint, Manor House ..	4·53
,,	New Radnor, Ednol	3·69	,,	Belfast, Cave Hill Road	4·94
,,	Birmingham WW., Tyrmynydd	6·21	,,	Glenarm Castle	5·00
,,	Lake Vyrnwy	9·06	,,	Londonderry, Creggan Res...	3·83
,,	Llangynhafal, Plas Drâw.....	2·91	,,	Dunfanaghy, Horn Head ...	....
,,	Rhwibryfdir	15·15	,,	Killybegs	6·17
,,	Dolgelly, Bryntirion.....	6·95			

Climatological Table for the British Empire, September, 1917.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	74·9	5, 8	43·0	30	69·8	51·9	54·5	...	119·9	43·8	2·31	11	6·6
Malta	89·6	2	63·5	30	82·5	72·0	...	76	140·0	...	1·70	1	0·8
Lagos	92·2	12	70·0	13	84·6	73·8	72·2	80	149·2	68·0	9·93	22	8·5
Cape Town	79.2	15	39·1	17	66·8	49·5	50·2	72	...	...	1·72	8	4·5
Johannesburg	76·0	7	38·2	14	67·1	46·3	44·0	75	...	34·0	1·14	8	5·6
Mauritius	78·2	8	55·5	28	75·5	61·5	57·4	69	...	49·6	·91	16	5·5
Bloemfontein	82·1	22	32·4	14	71·8	42·3	41·2	61	..	...	·51	3	3·5
Calcutta...	91·7	5	75·2	18	87·7	78·0	77·0	85	...	73·1	8·09	16	7·6
Bombay...	88·3	24	74·0	3	83·8	77·0	76·1	88	136·0	70·1	19·58	25	8·3
Madras	94·0	4	72·8	30	90·0	76·6	74·6	82	161·0	73·0	5·30	16	6·7
Colombo, Ceylon ...	87·1	15	72·8	25	84·4	75·4	73·6	84	154·8	68·8	12·74	23	8·0
Hongkong	89·9	20	74·3	23	86·6	76·1	74·2	77	...	...	4·88	12	5·0
Sydney	83·8	28	45·5	11	68·3	52·7	48·0	64	131·1	33·0	5·42	10	4·5
Melbourne	72·1	30	36·8	19	62·9	47·1	45·3	64	128·1	27·3	3·42	15	6·1
Adelaide	79·4	11	39·9	25	66·2	47·7	47·4	70	137·6	32·0	3·68	20	5·6
Perth	69.0	23	43·6	13	66·2	50·2	49·1	74	135·2	33·1	6·72	24	7·3
Coolgardie	78·6	30	33·0	4	67·6	43·9	38·7	46	138·4	29·0	·51	5	3·7
Hobart, Tasmania ..	70·3	21	38·0	15	58·6	44·0	41·1	65	132·7	28·1	3·76	19	6·8
Wellington	...	...	...	...	...	...	...	...	...	...	...	...	...
Auckland	...	...	...	...	...	...	...	...	...	...	...	...	...
Jamaica, Kingston ...	91·2	5	70·2	11	87·4	72·6	72·0	83	...	...	8·00	16	5·8
Grenada	91·0	20	70·0	29	86·0	75·0	...	79	138·0	...	6·89	19	5·0
Toronto	81·0	1	36·0	11	69·3	47·9	50·0	81	131·4	30·7	·65	8	3·4
Fredericton	82·0	19	29·0	23	67·7	40·4	47·6	80	...	...	·90	9	3·8
St. John, N.B. ...	78·0	27	35·0	23	63·2	46·3	47·8	75	135·2	30·5	1·24	9	4·0
Victoria, B.C.	76·0	1	46·0	20	61·8	49·9	50·0	83	131·2	36·5	1·06	15	5·5

Johannesburg.—Bright sunshine 237·5 hours.

COLOMBO, CEYLON.—Mean temp. 79°·9, or 1°·0 below, dew point equal to the average and R 7·85 in. above average. Mean hourly velocity of wind 5·6 miles.

HONGKONG.—Mean temp. 82°·0. Bright sunshine 266·5 hours. Mean hourly velocity of wind 10·4 miles.

Sydney.—Very severe gales and heavy R on the 19th with much damage to buildings, wires, shipping and trees.

Melbourne.—Temp. 1°·0 above, and R 1·03 in. above, averages. Northern rivers in flood. Crops good, fruit being a record yield.

Adelaide.—Mean temp. equal to the average, R 1·73 in. above, averages.

Perth.—Rainfall 3·53 in. above, average. Gales and high winds.

Coolgardie.—Temp. 2°·9 below, and R slightly below, averages.

KINGSTON, JAMAICA.—A hurricane passed across the island on 23rd, but not much damage was done. R twice the average.

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Meteorological Magazine.

No. 627. APRIL, 1918. Vol. LIII.

Sec. Lieut. Donald Sowerby Salter, R.G.A.

March 16th, 1890—March 22nd, 1918.

Mr. Donald Salter, cartographer to the British Rainfall Organization, who died on March 22nd from wounds received in action, was born in London and educated at Bancroft's School, Woodford. He was the younger brother of Mr. Carle Salter, Assistant Director of the British Rainfall Organization, and joined the staff of the Organization in 1908. He rapidly became extremely efficient in the intricate mapping work which plays such an important part in rainfall research. In order to improve a natural talent for map drawing he took a special course at the Camden School of Art, and acquired also a thorough professional knowledge of technical methods. His routine work included the plotting and drawing for reproduction of many hundreds of rainfall maps, most of which appeared in *British Rainfall* and *Symons's Meteorological Magazine* between 1908 and 1916, as well as a large number of annual rainfall maps of the British Isles, which are still unpublished. When Dr. H. R. Mill decided in 1910 to regroup the rainfall stations of the British Isles in river-divisions Mr. Donald Salter made a reduction of the watershed lines which he had drawn specially on the half-inch ordnance survey map as a basis for the new work. He also planned and carried out a specially reduced outline map of the British Isles for eventual use as the basis of a Rainfall Atlas, and re-drew the majority of the coloured plates for a new edition of Dr. H. R. Mill's "Realm of Nature." He was elected a fellow of the Royal Meteorological Society in March, 1915.

Mr. Donald Salter joined the Royal Engineers in 1916, under the Derby Scheme, and after being for a short time in the Ordnance Survey Department, Southampton, saw active service in France for some time. He was invalided home in October, 1916, and was granted a commission in the Royal Garrison Artillery in 1917. It was in carrying out the duties of Section Commander by his gun that he was fatally wounded at the outset of the great German offensive

of the past month. His brother officers speak in the highest terms of his gallant behaviour and example.

In spite of a manner extremely modest and retiring, Mr. Donald Salter had already made a large circle of friends, which his artistic and literary tastes constantly augmented. Many of these will value highly the beautifully executed drawings and paintings to which he devoted practically the whole of his leisure. To the Director and Staff of the British Rainfall Organization he proved throughout a devoted and enthusiastic colleague, the memory of whose work will long prove a stimulating tradition at Camden Square.

ROYAL METEOROLOGICAL SOCIETY.

At the meeting of the Royal Meteorological Society held at Caxton Hall, Westminster, on March 20th, Sir Napier Shaw, F.R.S., President, in the Chair, Dr. J. S. Owens, A.M.Inst.C.E., delivered a lecture illustrated by lantern slides on "The Measurement of Atmospheric Pollution."

Dr. Owens dealt with the need for exact measurements of suspended impurities in the air. He explained the work undertaken by the Advisory Committee on Atmospheric Pollution in this connection, and the methods used, and gave some of the results obtained during the last four years. He said that the era when a harmless gas like carbon-dioxide was taken as a measure of impurity was rapidly giving way to a recognition that the really important thing to measure was suspended dust and dirt. It was shown that the latter connoted great waste of human life and also of fuel, light and other important necessities.

As showing the kind of air city dwellers were sometimes forced to breathe he gave figures for deposit from the air for one year, April to March, at the following places :—

Oldham, 1915-16 ..	950	tons per square mile.
Manchester, 1915-16..	635	" " "
London, 1915-16 ..	453	" " "
Sheffield, 1914-15 ..	395	" " "
Malvern Wells, 1915-16	56	" " "

He stated that there was evidence of a general reduction of atmospheric impurity during the winter of 1916-17, as compared with the preceding winter, an effect probably due to reduced consumption of raw coal.

An account of the research work of the Advisory Committee, relating to methods of measurement, was also given, with an account of the special apparatus designed for the purpose, the preliminary difficulties encountered and the distribution of observing stations.

In conclusion mention was made of certain problems awaiting solution, such as relation of impurity to wind and distance from source, also to incidence of disease. Does smoke in the air reduce or increase the number of bacteria? What is the vertical distribution of suspended matter? The selective power of rain or snow in bringing down impurity.

The following gentlemen were ballotted for and elected fellows of the Society :—Messrs. R. T. Barratt, B.S., J. W. A. Brown, and A. S. MacDonald, of the U.S. Naval Reserve Flying Corps; Mr. E. McInnes, Lieut.-Comm. W. L. Marsh, R.N.V.R., and Messrs. W. G. W. Mitchell, B.Sc., C. F. Prance, A. C. Pratt, C.E., H. B. Pratt, and J. A. G. Simpson.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

GUNFIRE AND RAINFALL.

In Switzerland, during the most intense period of the heat and drought of the memorable summer of 1911, I had the good fortune to witness the remarkable spectacle of an immense colony of ants endeavouring, by means of the ejection of large quantities of formic acid, to extinguish a fire, which for experimental purposes had been introduced into their nest. They were ultimately successful. That night the drought was broken by one of the most violent thunderstorms within my experience.

The excuse for this note is not that I have mistaken your magazine for an entomological journal, but that I could not help wondering, while reading some of the correspondence in recent issues, whether popular opinion amongst the ant-colony attributed the thunderstorm to the prodigious expenditure of formic acid, and, if so, whether the ant-scientists were able to demonstrate that such was not the case.

Do we realize the immensity of Nature's laboratories and the colossal scale upon which her processes are conducted?

If the Krakatoa eruption, which visibly overcharged the world's atmosphere with volcanic dust for many months and was heard at a distance of 3000 miles, so far from occasioning a second flood, had no noticeable effect on rainfall, how can we, with our puny imitations, audible perhaps at 200 miles, expect to alter the course of Nature, even if all the world were one vast, twentieth-century battlefield? E. L. HAWKE.

S. Farnborough, Hants, March 4th, 1918.

UNUSUAL TEMPERATURE RANGE.

Your readers may be interested to hear that on March 24th, near Godalming (at an elevation of about 400 feet), the range of temperature in a Stevenson screen was 35°—71°. The fact that this maximum was 5° higher than that recorded at Kensington is not, perhaps, surprising, as it seems that there was considerable mistiness in town. A temperature of 71° in March, and a diurnal range of 36° at any season, must however, be very unusual. I cannot say whether either of these incidents constitutes a record for the district. G. WESTON.

47, Chester Terrace, S.W. 1, 26th March, 1918.

AN EXCEPTIONAL THERMOGRAPH RECORD.

THE second of the three warm-current assaults (January 15th, 16th and 18th), which finally broke the six weeks' cold spell was possibly unique. At first I feared my Lander and Smith thermograph had gone wrong. The record of 49° at 7.30 a.m. on the 15th, had fallen to 32°·5 by 9 p.m., when the vibrations indicate a half gale until 0.30 a.m. on the 16th, with temperature slightly lower until 1.45 a.m. By 2.50 a.m. it had jumped up 5°, falling back 3° by 3 a.m. Then began an unbroken rise to 49° in two hours, instantly and more rapidly beginning a fall back to 32°·5 by 6.50 a.m. It remained below 34° till the final change supervened at 6 p.m. on the 17th, 49° being reached about noon on the 18th, for the third time in January.

One is familiar with the sudden fall and rise of a summer cold wave thunderstorm, but this inversion is unique among my ten years of records. A rainfall record of 1·32 in. is a natural association for the twenty-four hours in question. J. EDMUND CLARK.

Asgarth, Riddlesdown Road, Purley, February 5th, 1918.

METEOROLOGICAL NEWS AND NOTES.

DR. H. R. MILL met with a serious accident on alighting from an omnibus in Camden Road on March 18th, from the result of which he was unconscious for several hours. He has suffered no permanent injuries, but the shock necessitated his remaining several weeks in hospital, and a prolonged rest has been recommended. The work of the British Rainfall Organization is being carried on meanwhile by Mr. Carle Salter.

MR. CARLE SALTER gave popular lectures on "Weather Maps," before the Hampstead Scientific Society on February 1st, and the Royal Flying Corps, Halton Camp, Wendover, on March 21st.

THE WEATHER OF MARCH, 1918, was exceptional for dryness and warmth in many parts of the country. We regret that pressure on our space prevents us from printing a number of interesting letters on the subject.

BLACK RAIN in the west of Ireland on March 6th is attributed by a local correspondent to the presence of soot carried from English factory chimneys. He adds, "This explanation illustrates vividly one drawback of our connection with England, and I am, therefore, pretty certain that Sinn Feiners will accept it, but I should add that very few people in these parts are satisfied with it. They prefer to call black rain a miracle."

INVERSE WEATHER PHENOMENA.

By L. C. W. Bonacina.

If the physical conditions which attend certain phenomena of the weather are examined, it is sometimes found that a set of conditions which favours the occurrence of one phenomenon may be just that which is essentially unfavourable to the occurrence of another. Two such phenomena may be regarded as inversely related. There is not, perhaps, any better guide to the discovery of such inverse relationships than is afforded by seasonal opposition in weather phenomena. If, for example, summer heat thunderstorms and winter cyclonic gales, or summer thunderstorms and winter land fogs show a complete seasonal antithesis in frequency and intensity there is reason to suspect that thunderstorms and gales on the one hand, or thunderstorms and fogs on the other, are not merely opposite phenomena seasonally, but are also inverse to one another in respect of one or more of the physical processes which underlie them. The term "inverse" will in this article be used to indicate opposition among the underlying factors concerned in producing one of a given pair of phenomena, and not opposition in the phenomena themselves, which may exhibit no physical contrast at all in the sense, for instance, in which windiness and calmness, or cloudiness and sunniness, are necessarily opposite conditions.

In this paper it is intended to consider a few of the more striking phenomena which in this climate exhibit well-marked seasonal opposition, and to point out in what way they may be regarded as inverse. The discussion will for the sake of brevity refer only to the climate of the British Isles; but what holds for these islands is also true for a great part of the North Temperate zone. The following weather events will be brought under review:—thunderstorms, gales, fogs, rainstorms and snowstorms. If the question were suddenly put to a number of persons, among them meteorologists: What is the inverse seasonal phenomenon of the summer thunderstorm? it is probable that the majority would immediately answer the winter snowstorm. They would argue that snowstorms require of necessity a certain degree of cold, and thunderstorms, though able to occur with any temperature, are certainly favoured by a certain degree of heat. But a study of the average monthly frequency of snow and thunder does not show complete, but only approximate, seasonal antithesis—a fact which suggests a great deal. The months of greatest thunder frequency coincide with the summer half-year April to September; but the months of greatest snow frequency are not entirely coincident with the winter half-year October to March, inasmuch as April has a decidedly higher frequency than October. Examination of local climatological records shows this; but the fact is apparent to casual observation. In other words

the snow season overlaps into the thunder season, and this is quite sufficient to suggest that the basal physical conditions which occasion thunderstorms and snowstorms are not essentially inverse as might at first be supposed. On the contrary, it is noteworthy that the broad barometric situation which is conducive to heavy local snowfalls in the cold season is often curiously similar to that which is conducive to heavy local thunderstorms in the warm season, since both commonly occur when the pressure distribution is typically complex and irregular, and both likewise have a peculiar way of developing unexpectedly in what often appears to be settled fine weather with hard frost in the one case and baking drought in the other. This does not necessarily argue a close dynamical analogy between the immediate determining conditions of local snowstorms in winter and of thunderstorms in summer inasmuch as the atmospheric instability which is the essential condition of thunderstorm activity is absent in the case of simple snowfalls ; but it does help one to understand what the lack of full seasonal opposition intimates, namely, that snowstorms and thunderstorms though perhaps the most striking features of the cold and warm months respectively, are not such truly inverse phenomena as certain other pairs of phenomena to be considered. What, then, is the inverse of the thunderstorm among ordinary weather phenomena? In the first place it must be a matter of general experience to all who watch the English climate closely that just as land thunderstorms belong in the main to the summer half of the year, April-September, so do cyclonic gales as well as land (valley or plain) fogs belong to the winter half-year, October to March ; and, further, that the special period for summer thunderstorms is around the solstice, May to August and for both gales and fogs around the other solstice, November to February. It is during the seven or eight weeks on either side of June 21st that the really violent electrical storms burst at intervals over the country, and it is during the dark weeks round Christmas that the most destructive gales rage most frequently, and also, curiously enough, the paralyzing land fogs which need calm conditions are generally bred. But since all meteorologists do not receive general climatic impressions with the same force it is necessary to support these statements with such statistical data on the seasonal variations of thunderstorms, gales and fogs as is readily available. All three phenomena were investigated seasonally some years ago by Mr. F. J. Brodie.* His figures, giving the mean monthly frequency of thunderstorms at a number of stations in

* *See* Q.J.R. Met. Soc., Vol. 28, 1902, for paper on "Gales of British Isles," and Vol. 31, 1905, for paper on "Fogs of London." An unpublished paper on "British Thunderstorm Distribution," was read at a meeting of the Roy. Met. Soc. about 1906, and the data on which it was based are now, by the kindness of Mr. Brodie, in charge of the writer.

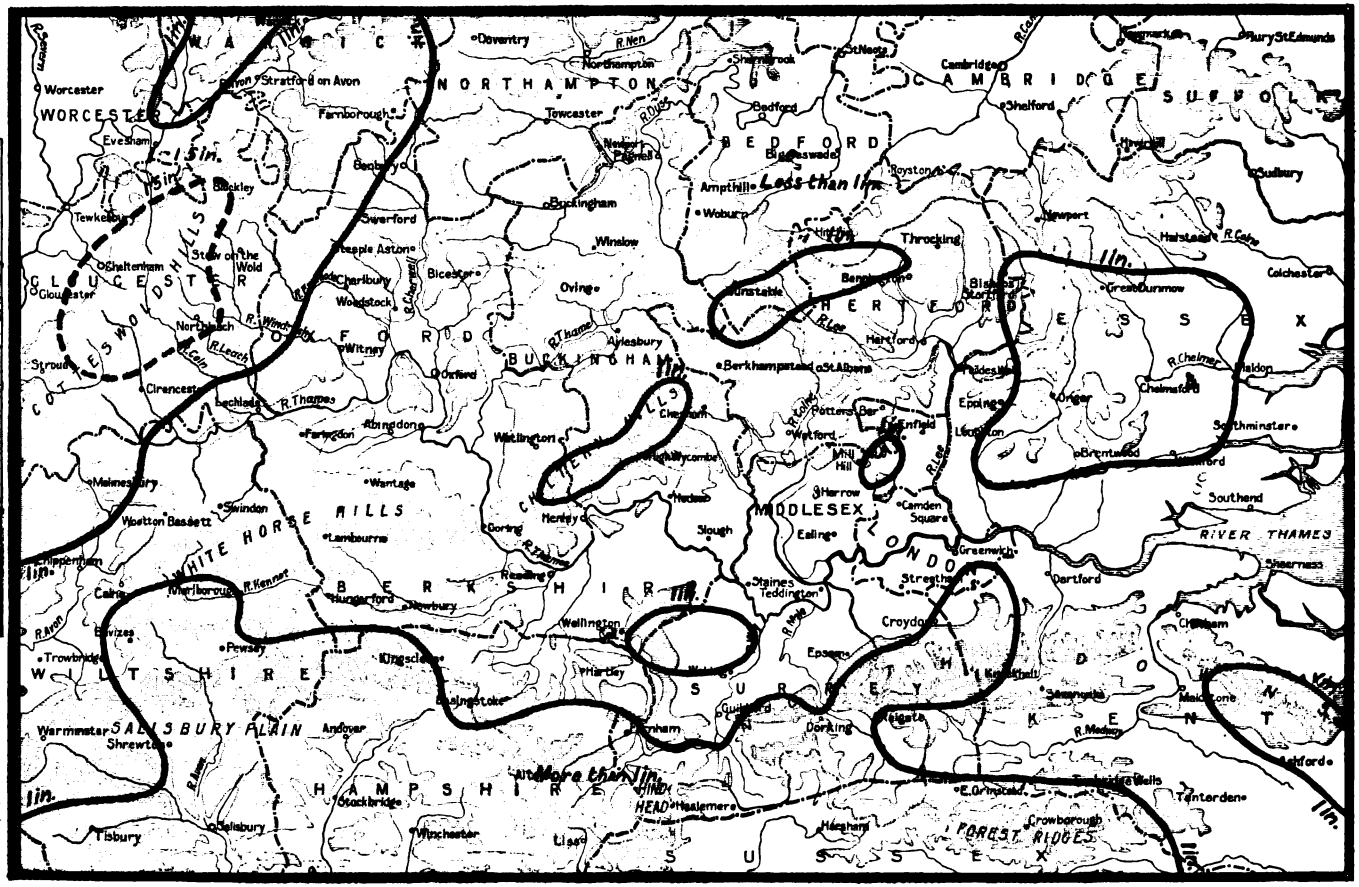
the British Islands for a period of twenty-five years show, taking the country as a whole, a well-marked maximum between May and August in conformity with general experience. Brook's figures for the U.S.A. reveal the same feature, as also Angot's for the Paris district of France. In the Mediterranean, however, the researches of Eredia and others indicate that the maximum, as a result of the special climatic regime of that region, is deferred till the autumnal equinox. With the exception of the stations on the extreme western seaboard of Scotland and Ireland, where the annual number of thunderstorms is small, and where there can hardly be said to exist a definite seasonal range, thunderstorms being as common in winter as in summer, all the rest of the kingdom experiences storms of the summer heat type far more frequently than those of the winter cyclonic type.

(*To be continued.*)

THE GENERAL STRUCTURE OF THE ATMOSPHERE.

At a meeting of the Geophysical Committee of the British Association, held in the rooms of the Royal Astronomical Society on Thursday, December 13th, Prof. Schuster in the Chair, Sir Napier Shaw opened a discussion on "The General Structure of the Atmosphere." The address began with a description of the chemical composition of a quiescent atmosphere as computed from the ascertained composition of the surface layer. The outer layers are composed of hydrogen and helium, with probably a layer of geosoronium still further out. Water vapour loses its importance at 10 kilometres, at 57 kilometres hydrogen begins to displace nitrogen and oxygen, and at 80 kilometres the replacement is complete. Meteorological phenomena take place in a very small portion of the atmosphere about 10 kilometres thick called the troposphere. This region marks the boundary of convection, and it is the stop of convection that determines the boundary of the troposphere. The height of the top of the latter ranges from 10,600 m. in our latitudes to 17,000 m. over the equator. In the stratosphere temperature does not fall off with height. The intermediate layer is known as the tropopause. In the stratosphere the wind when observed with pilot balloons falls off rapidly with height, but the whole subject of wind at great heights is somewhat confused and further data are required. The upper layers are liable to as great variations in winds as the lower layers, which display such a very complex structure. The various thermodynamic conditions and the chemical composition of the surface air were also referred to in the discussion which was illustrated by slides.

THAMES VALLEY RAINFALL MARCH, 1918.


ALTITUDE SCALE
Below 250 feet
250 to 500 feet
500 to 1000 feet
Above 1000 feet
SCALE OF MILES
Less than 1in.
1in.
More than 1in.
Isohyetals
Coventry
Northampton
Worcester
Stratford on Avon
Towcester
Bedford
Cambridge
Bury St Edmunds
Evesham
Tewkesbury
Cheltenham
Stow on the Wold
Gloucester
Buckingham
Winslow
Oxford
Woodstock
Bicester
Witney
Aylesbury
Berkhampsted
St Albans
Hertford
Dunstable
Luton
Epping
Ongar
Chelmsford
Colchester
Maldon
Southminster
Southend
Cirencester
Lechlade
Faringdon
Abingdon
Wantage
Wallingford
Chesham
Watford
Harrow
Mill Hill
Ealing
Slough
Henley
Reading
Newbury
Hungerford
Lambourn
Swindon
Wootton Bassett
Marlborough
Calne
Devizes
Pewsey
Trowbridge
Kingsclere
Basingstoke
Andover
Salisbury
Warminster
Shrewton
Stockbridge
Winchester
Tisbury
Whitchurch
Hazeley
Wellington
Thirsley
Guildford
Dorking
Epsom
Croydon
Streatham
Greenwich
Dartford
Sheerness
Chatham
Maidstone
Ashford
Tenterden
Tunbridge Wells
Crowborough
Hastings
Camden Square
Staines
Teddington
Uckfield
Lewes
Eastbourne
Brighton
Chichester
Petersfield
Alton
Basingstoke
Reigate
Horsham
Midhurst
Arundel
Worthing
Littlehampton
Bognor
Portsmouth
Southampton
Lymington
Ringwood
Christchurch
Bournemouth
Swanage
Weymouth
Dorchester
Sherborne
Yeovil
Crewkerne
Chard
Axminster
Honiton
Exeter
Sidmouth
Ottery St Mary
Tiverton
Wellington
Taunton
Bridgwater
Minehead
Dulverton
Barnstaple
Ilfracombe
Bideford
Hartland
Launceston
Okehampton
Tavistock
Plymouth
Kingsbridge
Totnes
Newton Abbot
Teignmouth
Torquay
Dawlish
Exmouth
Sidmouth
Cullompton
Tiverton
Bampton
Dulverton
Minehead
Watchet
Williton
Dunster
Porlock
Lynton
Ilfracombe
Barnstaple

THE WEATHER OF MARCH.

ALTHOUGH the type of pressure distribution showed considerable variations, there was, throughout the whole of March, a marked tendency for the establishment of anticyclonic conditions. The mean barometric pressure of the month was, therefore, high, and was also extremely uniform; temperature was above the average; rainfall was slight, and the duration of bright sunshine, though very deficient in north Britain, was slightly in excess of the normal in most other parts of the Kingdom.

The month opened with cold northerly winds, and local falls of snow or sleet, and on the first two nights a keen frost prevailed, the sheltered thermometer falling below 25° in many places, and reaching 17° at West Linton and 9° at Balmoral. Between the 2nd and the 8th the borders of an anticyclone centred over northern Europe, occasionally extended over a large portion of the United Kingdom. In the south the weather was affected adversely by a depression which moved in an unusual course from the Netherlands across the north of France to the Atlantic; and on the 3rd the easterly wind in the Channel reached the force of a gale. After the 9th a series of disturbances passed in quite a normal track across Iceland and caused unsettled weather on our western and northern coasts. Elsewhere the weather, though subject to local fogs, was mostly fair and dry, and on the 11th and 12th the day temperatures in many parts of England passed beyond 60°. After this a new anticyclone from the Atlantic drifted north-eastwards across the United Kingdom and in the middle of the month the wind was easterly or south-easterly, and the weather rather cold, a sharp frost occurring on the night of the 16th.

The most pronounced anticyclonic spell occurred between the 20th and 26th, when a well-marked system appears to have been developed immediately over England and France. During its prevalence intermittent sea fogs of considerable density prevailed round our western and southern coasts, and caused, in the localities affected, a raw cold air. Elsewhere the weather was fair, sunny and warm in the daytime, but cold at night. On the 23rd and 24th the thermometer in many inland parts of England rose slightly above 70°. During the closing days of the month the weather was affected in all districts by cyclonic areas, which passed eastwards directly across the United Kingdom. The weather, therefore, fell into an unsettled showery state generally; a thunderstorm occurred on the 29th in London, and also in the south of Ireland (at Cahirciveen), and on the 31st in several isolated parts of England.

Aurora was seen in Scotland on the 1st and 2nd, and at a number of stations situated in the more northern and eastern parts of Great Britain on 7th.

The rainfall for the month was nearly everywhere below the average, less than 1 inch falling over much of the east of England, and less than 2 inches over nearly the whole country. In Wales parts of the mountainous districts had more than 4 inches. The east of Scotland was also dry and the fall in the west Highlands was moderate. The south of Ireland had rather more than 2 inches, whilst the fall in the north was smaller. The general rainfall of the countries expressed as a percentage of the average was:—England and Wales, 62; Scotland, 48; Ireland, 65; British Isles, 58.

In London (Camden Square) the mean temperature was 43°·5, or 1°·4 above the average of 50 years. The duration of bright sunshine was 102·4 hours, and the duration of rainfall, 16·1 hours. Evaporation, ·85 in.

RAINFALL TABLE FOR MARCH, 1918.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875–1909. in.	1918. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	1·70	1·09	— ·61	64	·51	30	8
Tenterden	*Kent*	1·95	·81	—1·14	42	·34	30	8
Arundel (Patching)	*Sussex*	1·95	1·48	— ·47	76	·64	30	9
Fordingbridge (Oaklands)	*Hampshire*	2·09	1·27	— ·82	61	·47	30	12
Oxford (Magdalen College)	*Oxfordshire*	1·45	·60	— ·85	42	·24	30	12
Wellingborough (Swanspool)	*Northampn*	1·72	·65	—1·07	38	·25	30	10
Bury St. Edmunds (Westley)	*Suffolk*	1·71	·62	—1·09	37	·32	30	6
Geldeston [Beccles]	*Norfolk*	1·57	·78	— ·79	56	·27	30	13
Polapit Tamar [Launceston]	*Devon*	2·74	1·77	— ·97	65	·59	31	11
Rousdon [Lyme Regis]	,,	2·30	1·86	— ·44	82	·58	30	12
Stroud (Field Place)	*Gloucester*	2·01	1·30	— ·71	65	·30	31	10
Church Stretton (Wolstaston)	*Shropshire*	2·19	1·72	— ·47	79	·48	31	10
Boston	*Lincoln*	1·47	·60	— ·87	41	·19	30	10
Worksop (Hodsock Priory)	*Nottingham*	1·70	·85	— ·85	50	·30	30	11
Mickleover Manor	*Derbyshire*	1·69	1·48	— ·21	88	·61	29	8
Buxton	,,	3·99	...	...	...	...	..	...
Southport (Hesketh Park)	*Lancashire*	2·11	1·13	— ·98	54	·25	27	10
Arncliffe Vicarage	*York, W.R.*	5·17	...	...	...	...	...	...
Wetherby (Ribston Hall)	,, ,,	1·92	1·39	— ·53	74	·33	28	8
Hull (Pearson Park)	,, *E.R.*	1·84	·84	—1·00	46	·36	30	13
Newcastle (Town Moor)	*North'land*	2·10	1·17	— ·93	56	·25	5	13
Borrowdale (Seathwaite)	*Cumberland*	10·63	5·65	—4·98	53	1·90	27	11
Cardiff (Ely)	*Glamorgan*	2·89	2·88	— ·01	100	·54	28	15
Haverfordwest	*Pembroke*	3·16	3·06	— ·10	97	·65	27	13
Aberystwyth (Gogerddan)	*Cardigan*	3·04	3·24	+ ·20	107	·96	31	8
Llandudno	*Carnarvon*	2·13	·94	—1·19	44	·30	31	8
Cargen [Dumfries]	*Kirkcudbrt.*	3·33	1·93	—1·40	58	·47	27	10
Marchmont House	*Berwick*	2·64	1·23	—1·41	47	·24	28	14
Girvan (Pinmore)	*Ayr*	3·62	1·38	—2·24	38	·40	28	11
Glasgow (Queen's Park)	*Renfrew*	2·61	1·40	—1·21	54	·67	31	10
Islay (Eallabus)	*Argyll*	3·68	1·99	—1·69	54	·63	27	11
Mull (Quinish)	,,	4·28	2·59	—1·69	61	·55	30	15
Balquhidder (Stronvar)	*Perth*	6·02	2·65	—3·37	44	1·00	28	11
Dundee (Eastern Necropolis)	*Forfar*	2·06	1·09	— ·97	53	·30	30	15
Braemar	*Aberdeen*	2·87	·65	—2·22	28	·15	28, 30	10
Aberdeen (Cranford)	,,	2·65	1·79	— ·86	68	·67	28	16
Gordon Castle	*Moray*	2·36	1·19	—1·17	50	·36	28	14
Drumnadrochit	*Inverness*	3·09	·88	—2·21	29	·28	27	9
Fort William	,,	6·39	2·41	—3·98	38	·47	11	14
Loch Torridon (Bendamph)	*Ross*	7·29	3·94	—3·35	54	·74	27	17
Dunrobin Castle	*Sutherland*	2·64	1·32	—1·32	50	·60	27	7
Killarney (District Asylum)	*Kerry*	4·51	3·11	—1·40	69	·67	28	15
Waterford (Brook Lodge)	*Waterford*	2·64	2·55	— ·09	97	·46	29	15
Nenagh (Castle Lough)	*Tipperary*	2·99	2·51	— ·48	84	·73	29	12
Ennistymon House	*Clare*	3·24	2·55	— ·69	79	·73	29	11
Gorey (Courtown House)	*Wexford*	2·28	1·97	— ·31	87	·43	29	14
Abbey Leix (Blandsfort)	*Queen's Co.*	2·59	2·35	— ·24	91	·45	29	13
Dublin (Fitz William Square)	*Dublin*	1·98	1·03	— ·95	53	·18	27	13
Mullingar (Belvedere)	*Westmeath*	2·64	2·51	— ·13	95	·55	31	10
Crossmolina (Enniscoe)	*Mayo*	4·36	1·56	—2·80	36	·44	27	12
Cong (The Glebe)	,,	3·80	2·35	—1·45	62	·76	28	13
Collooney (Markree Obsy.)	*Sligo*	3·33	1·62	—1·71	49	·47	27	11
Seaforde	*Down*	2·84	1·39	—1·45	49	·41	29	10
Ballymena (Harryville)	*Antrim*	3·07	1·35	—1·72	45	·28	29	10
Omagh (Edenfel)	*Tyrone*	2·98	1·51	—1·47	51	·35	11	11

SUPPLEMENTARY RAINFALL, MARCH, 1918.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	1·27	XI.	Lligwy	1·45
,,	Ramsgate	·96	,,	Douglas, Isle of Man	2·02
,,	Hailsham	1·16	XII.	Stoneykirk, Ardwell House...	1·24
,,	Totland Bay, Aston House...	1·04	,,	Carsphairn, Shiel	2·84
,,	Stockbridge, Ashley..	1·03	,,	Langholm, Drove Road	1·75
,,	Grayshott	1·54	XIII.	Selkirk, The Hangingshaw..	·45
III.	Harrow Weald, Hill House...	·78	,,	North Berwick Reservoir	1·04
,,	Pitsford, Sedgebrook	·61	,,	Edinburgh, Royal Observaty.	·50
,,	Woburn, Milton Bryant	·67	XIV.	Biggar	·57
,,	Chatteris, The Priory	·51	,,	Maybole, Knockdon Farm ...	1·32
IV.	Elsenham, Gaunts End	·99	XV.	Buchlyvie, The Manse	1·82
,,	Shoeburyness	·85	,,	Ardgour House	3·42
,,	Colchester, Hill Ho., Lexden	·91	,,	Oban	1·99
,,	Ipswich, Rookwood, Copdock	·83	,,	Campbeltown, Witchburn ..	2·10
,,	Aylsham, Rippon Hall	·69	,,	Holy Loch, Ardnadam	3·23
,,	Swaffham	·68	,,	Tiree, Cornaigmore	...
V.	Bishops Cannings	1·08	XVI.	Glenquey	2·10
,,	Weymouth	1·04	,,	Glenlyon, Meggernie Castle..	...
,,	Ashburton, Druid House	2·05	,,	Blair Atholl	1·19
,,	Cullompton	1·82	,,	Coupar Angus	·86
,,	Lynmouth, Rock House	2·44	,,	Montrose, Sunnyside Asylum.	1·15
,,	Okehampton, Oaklands	1·99	XVII.	Balmoral	·96
,,	Hartland Abbey	1·36	,,	Fyvie Castle	1·61
,,	St. Austell, Trevarna	1·77	,,	Keith Station	2·14
,,	North Cadbury Rectory	1·05	XVIII.	Rothiemurchus	·72
VI.	Clifton, Stoke Bishop	1·79	,,	Loch Quoich, Loan	6·80
,,	Ledbury, Underdown	1·59	,,	Skye, Dunvegan	3·32
,,	Shifnal, Hatton Grange	1·41	,,	Fortrose	·83
,,	Droitwich	1·06	,,	Glencarron Lodge	2·86
,,	Blockley, Upton Wold	1·73	XIX.	Tongue Manse	1·96
VII.	Grantham, Saltersford	·77	,,	Melvich	1·29
,,	Market Rasen	·45	,,	Loch More, Achfary	2·79
,,	Bawtry, Hesley Hall	·76	XX.	Dunmanway, The Rectory ..	3·78
,,	Whaley Bridge, Mosley Hall	2·19	,,	Glanmire, Lota Lodge	3·41
,,	Derby, Midland Railway	1·29	,,	Mitchelstown Castle	2·54
VIII.	Nantwich, Dorfold Hall	1·06	,,	Darrynane Abbey	3·10
,,	Bolton, Queen's Park	2·13	,,	Clonmel, Bruce Villa	2·21
,,	Lancaster, Strathspey	1·66	,,	Broadford, Hurdlestown	2·62
IX.	Langsett Moor, Up. Midhope	1·36	XXI.	Enniscorthy, Ballyhyland...	2·57
,,	Scarborough, Scalby	1·12	,,	Rathnew, Clonmannon	1·60
,,	Ingleby Greenhow	1·33	,,	Ballycumber, Moorock Lodge	1·99
,,	Mickleton	1·30	,,	Balbriggan, Ardgillan	1·26
X.	Bellingham, High Green Manor	1·22	,,	Castle Forbes Gardens	1·71
,,	Ilderton, Lilburn Cottage	·75	XXII.	Ballynahinch Castle	...
,,	Keswick, The Bank	2·11	,,	Woodlawn	1·76
XI.	Llanfrechfa Grange	2·86	,,	Westport, St. Helens	2·45
,,	Treherbert, Tyn-y-waun	4·88	,,	Dugort, Slievemore Hotel ...	1·89
,,	Carmarthen, The Friary	2·70	XXIII.	Enniskillen, Portora	1·13
,,	Fishguard, Goodwick Station.	2·64	,,	Dartrey [Cootehill]	1·85
,,	Crickhowell, Tal-y-maes	6·00	,,	Warrenpoint, Manor House ..	2·05
,,	New Radnor, Ednol	2·42	,,	Belfast, Cave Hill Road	1·18
,,	Birmingham WW., Tyrmynydd	3·55	,,	Glenarm Castle	1·14
,,	Lake Vyrnwy	2·13	,,	Londonderry, Creggan Res...	1·31
,,	Llangynhafal, Plas Drâw	·69	,,	Dunfanaghy, Horn Head	...
,,	Rhwibryfdir	6·14	,,	Killybegs	2·33
,,	Dolgelly, Bryntirion	4·24			

Climatological Table for the British Empire, October, 1917.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain Depth.	Total Rain Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	71·9	2	30·1	28	55·9	40·3	42·4	87	111·7	29·3	3·26	19	7·0
Malta	87·8	12	56·8	23	75·0	65·4	...	88	142·0	...	1·67	7	2·1
Lagos	96·0	3	71·2	1	87·0	74·1	73·7	77	155·3	69·0	4·94	16	7·8
Cape Town	84.0	28	46·0	4	71·7	52·9	52·1	68	...	...	1·10	7	4·9
Johannesburg	84·3	30	38·3	28	75·9	51·5	43·6	55	...	37·5	·65	6	3·3
Mauritius	...	...	...	...	...	...	...	...	...	...	...	...	...
Bloemfontein	87·2	7	35·4	19	79·8	48·1	43·5	45	..	...	·05	1	4·8
Calcutta...	90·0	20	74·2	9	86·6	76·5	75·7	85	...	68·1	11·31	11	6·0
Bombay...	89·9	21	71·3	31	84·7	76·3	74·1	82	144·1	63·1	16·11	18	6·3
Madras	94·5	9	72·0	2	89·0	75·3	72·7	79	162·4	68·0	16·48	11	5·1
Colombo, Ceylon ...	86·4	12	70·5	31	84·5	75·0	72·3	81	158·8	64·6	4·24	16	6·4
Hongkong	86·8	16	66·9	30	81·3	73·8	67·7	73	...	...	3·47	6	3·3
Sydney	88·8	20	44·9	10	70·4	56·3	52·0	63	135·2	38·2	4·41	16	5·2
Melbourne	79·0	16*	35·1	8	66·6	49·7	46·8	64	142·4	25·3	3·65	17	6·6
Adelaide	87·3	16	37·7	9	69·3	49·9	48·7	66	144·5	31·3	2·09	17	6·1
Perth	85·5	29	40·9	4	68·1	52·2	47·9	62	151·4	30·5	2·89	16	4·8
Coolgardie	89·8	31	38·0	4	73·0	47·4	40·4	41	154·4	34·0	·55	5	2·9
Hobart, Tasmania ...	76·0	13	35·0	11	61·7	45·7	42·8	64	144·6	28·4	2·79	19	6·8
Wellington	65·5	28	37·2	14	60·5	51·3	49·0	77	143·0	27·3	2·51	15	6·7
Jamaica, Kingston ...	90·3	6	68·3	24	87·8	71·7	71·1	84	...	...	2·05	6	5·0
Grenada	89·0	12	72·0	14	85·0	75·0	...	78	139·0	...	7·92	20	3·5
Toronto	62·2	2	29·0	21	52·2	36·9	37·5	83	120·8	22·6	4·78	17	...
Fredericton	65·0	1, 4	27·5	27	54·1	35·6	40·3	88	...	...	7·32	18	5·6
St. John, N.B. ...	62·7	31	33·5	27	52·8	40·1	41·8	81	121·2	27·3	7·91	15	5·8
Victoria, B.C.	69·4	4	36·8	28	56·7	36·8	46·0	85	119·0	29·0	1·02	9	5·5

* and 19

Johannesburg.—Bright sunshine 331·2 hours.

COLOMBO, CEYLON.—Mean temp. 79°·8, or 0°·3 below, dew point 1°·4 below, and R 9·04 in. below, averages. Mean hourly velocity of wind 5·1 miles.

HONGKONG.—Mean temp. 77°·0. Bright sunshine 258·8 hours. Mean hourly velocity of wind 14·0 miles.

Melbourne.—Mean temp. 0°·6 above, and R 1·06 in. above, averages.

Adelaide.—Mean temp. 2°·4 below, and R ·37 in. above, averages.

Coolgardie.—Temp. 3°·6 below, and R normal.

Wellington.—Mean temp. 5°·7 above, and rainfall 1·71 in. below, averages. Bright sunshine 155 hours, frosts on three days, cloudy and showery month.

JAMAICA.—Rainfall below average over the whole island.

Symons's Meteorological Magazine.

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INVERSE WEATHER PHENOMENA.

(Continued.)

By L. C. W. Bonacina.

It will be instructive here to quote the mean monthly frequencies for three English stations in Mr. Brodie's list, namely, Oxford, a typical Thames Valley district in the South Midlands, Cambridge, a locality characteristic of the flat Fen Country, in the East Midlands, and Stonyhurst a north country station climatically influenced by the bold relief of the Pennine Chain:—

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Cambridge—	—	0·12	0·32	0·72	*2·32*	*3·32*	*3·40*	*2·56*	1·32	0·52	0·08	—	14·68
Oxford—	0·04	—	0·16	0·60	*1·56*	*2·40*	*2·48*	*1·84*	1·08	0·32	0·04	0·08	10·60
Stonyhurst—	0·24	0·40	0·52	1·12	*2·28*	*2·76*	*3·40*	*3·52*	1·72	1·16	0·52	0·32	17·96

In all three cases the May-August maximum is conspicuously brought out; and the only anomaly worthy of note is that at Stonyhurst, where winter thunderstorms figure more prominently than in the south and east of England, the frequency shows some disposition to be displaced towards the autumnal side of summer as evidenced by the maximum in August and the slightly higher value for October than for April. The fact that May, with a lower mean temperature of the air than September brings more frequent and severe thunderstorms points indubitably to the importance of direct solar heating in their production. In July the factors of direct sun heat and accumulated warmth apparently combine at most places to cause the highest thunder frequency of the four summer months. It should be remembered, however, that Mr. Brodie's figures do not distinguish different types of thunderstorm, and that many of the passing thunder showers common in the rather wet months of July and August are electrically speaking of a mild character, though the rainfall may be torrential. At all events the

writer becomes yearly more convinced that it is the first heat of the summer in May and June that is so prone to breed violent electrical disturbance, and that spells of hot weather later in the summer are on the whole less conducive to sudden local instability, the July and August storms occurring more characteristically in spells of unsettled, broken and relatively cool weather. But such details, though interesting, are incidental, and do not affect the main proposition, namely, that the heat, or land, thunderstorms of the summer season in general are grouped in mean frequency and intensity more or less symmetrically round the high solstice.

Mr. Brodie's figures for gale frequency around the British coasts as a whole, on the basis of 33 years' observations, represent "severe" gales (Beaufort force 10) alone, as well as the total number of gales. The designation of a "gale" is, of course, more or less arbitrary, and such being the case, the seasonal variations of cyclonic storms are, perhaps, as well or better emphasized by studying the figures for the "severe" storms only, which are herewith quoted :—

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Winter Half-Year..	1·2	1·7	2·0	2·2	1·2	1·2
	April	May	June	July	Aug.	Sep.
Summer Half-Year	0·3	0·1	0·1	—	0·2	0·5

The distribution of total number of gales is similar, but the figures are about three times as great for the winter months and about eight times for the summer months. It will be seen that severe gales are virtually relegated to the winter half of the year, with a prominent solstitial maximum, November to January, in exact accordance with ordinary experience. The minimum is diametrically opposite, May to July or August, when thunderstorms are at their maximum. It is, therefore, evident that the equinoxes bound the gale season, and that instead of "equinoctial gales," which, in a seasonal sense, have no existence, we ought correctly to speak of "winter solstitial gales." The minor irregularity which represents February equal to March and October in the number of severe gales instead of greater may possibly be due to the shortness of the month, but even if it is real it does not obscure the broad clear association of gales with the winter six months and very especially with the midwinter or solstitial three months.

Mr. Brodie's figures for the mean fog frequency only refer to London, and consequently hardly have the same significance in this article as those for the gales and thunderstorms. They are based on a 38-year period and are as follows :—

	Oct.	Nov.	Dec.	Jan.	Feb.	March
Winter Half-Year	7·8	8·5	9·5	8·2	6·4	4·8
	April	May	June	July	Aug.	Sept.
Summer Half-Year	2·0	0·8	0·6	0·4	1·2	4·7

Here, again, the winter solstitial maximum, November to January, stands out in company with the gale predominance in the same period, and in opposition likewise to the summer solstitial minimum May to July. A minor anomaly indicates a rather higher frequency in equinoctial October than in February, which is mainly a solstitial month*, but it should be noted that under the term "fog," especially London fog, a variety of dark, misty appearances are liable to be included, and that it is the true land radiation (valley or plain, as distinct from mountain or hill) fogs which are under discussion. Dense surface fog in London as a day phenomenon is practically confined to November, December and January, when the sun is lowest, but by night it is common enough in October and February, and occasionally develops in September and March, or even April. The interesting point, however, to observe is this: that in the London Basin gales and fogs which are irreconcilable phenomena and cannot occur simultaneously, have a seasonal variation which is practically identical, the one or other meteorological event occurring according as the temporary conditions are cyclonic or anticyclonic, etc.

The seasonal opposition between gales and thunderstorms on the one hand and between fogs and thunderstorms on the other, being demonstrated, the question arises whether the facts can be interpreted to a certain extent in the light of physical inversion.

The fog-thunderstorm case had better be considered first as it is the easier to explain, having, indeed, already been discussed by Sir Napier Shaw.† It is a question of stability or instability. Solar radiation at the summer solstice effects a great amount of surface heating, which is conducive at intervals to a condition of atmospheric instability favourable to those convective disturbances of which thunderstorms are the meteorological exponent. Terrestrial radiation at the winter solstice, on the contrary, promotes shallow surface cooling which induces a stable condition of the air strata, one of the essential predisposing causes of dense and occasionally prolonged surface fog. Sir Napier Shaw says: "Hence to a certain extent fogs and thunderstorms may be regarded as inverse phenomena and for a good physical reason. The surface fog is characteristic of stability in the stratification of the atmosphere; the thunderstorm on the contrary of marked instability." This, of course, refers to winter land fogs as opposed to summer land thunderstorms. It may be observed, moreover, that certain physical divisions of the country, *e.g.*, the Thames Valley, which have a somewhat evil notoriety for their fog-breeding capacity in the depth of winter have also a rather sinister reputation for electrical disturbance in the height of summer.

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*The solstitial periods roughly comprise eight months out of the twelve.

† "Forecasting Weather," p. 292.

The cyclonic gale-thunderstorm case is more difficult to expound, and is little understood at the present time. It is not a simple question of stability *versus* instability, but depends upon another relation, namely the dynamical opposition between two essentially different types of circulation. This subject was investigated for the first time by the writer in a paper* on, "The Re-adjustment of Pressure Differences: Two Species of Atmospheric Circulation and their Connection." Cyclonic gales, as has been demonstrated, occur primarily around midwinter, thunderstorms around midsummer, a fact which may be interpreted in the following manner, the physical explanation being sought in the paper above quoted. At the low solstice storm energy takes the form of a fairly uniform diffuse system of horizontal air motion round areas of deep barometric depression. At the high solstice, on the other hand, storm energy is concentrated in local patches of vertical (convective) air motion in such a manner that although the individual thunderstorms so engendered are only local, the total area of disturbed electrical conditions is as great as that which in winter would form the central core of a cyclonic depression commanding a system of wind energy. It is attempted to show elsewhere that the two species of circulation are, as regards a given disturbing force, dynamically inconsistent with one another; and that whilst cyclonic wind energy greatly accentuates in accordance with the effect of the earth's rotation the original difference of pressure which generates it in the first place, the vertical circulation of thunderstorm commotion neutralizes any such disturbing variation of pressure, thus preventing the development of barometric-gradient winds with respect to a cyclonic minimum. It is shown why at the high solstice dynamical conditions do not permit of so much horizontal motion as at the low solstice, and that *ipso facto* instability ensues at the former season with consequent vertical motion instead of the prohibited horizontal. Thunderstorm circulation may, of course, occur locally superimposed upon cyclonic circulation, and such instances are best exemplified in the case of quick-travelling winter thunderstorms which are invariably of the line-squall type, and are more common along the Atlantic seaboard of Scotland and Ireland than elsewhere.

It should be noted, furthermore, that winter gales and fogs, being both in different senses inverse to summer thunderstorms are in one very patent sense inverse to one another in that valley or plain fogs are conditioned by a calm atmosphere. Since both these meteorological events occur at the same time of year, in this case there is no seasonal opposition to hint at their inverse character which, however, is obvious to the senses.

(*To be continued.*)

* Q.J.R. Met. Soc., Vol. 42, 1916.

ROYAL METEOROLOGICAL SOCIETY.

A MEETING of this Society was held on April 17th at 70, Victoria Street, S.W., Col. H. Mellish, C.B., Vice-President, in the Chair.

Mr. E. G. Bilham, B.Sc., read a paper entitled, "The Variations of Underground Water Level near a Tidal River." The paper was chiefly devoted to a comparison of records from the Kew Observatory water-level recorder and the Richmond Lock tide-gauge for a period of two years from May, 1914. The seasonal variations, determined from lunar monthly means, are found to be similar, as was to be anticipated on general grounds. A better method of determining the extent to which the variations of sub-soil water-level are directly controlled by the river Thames consists in the analysis of the well records to find tidal oscillations analogous to those which are well marked in the river. The well responds but slightly to the lunar semi-diurnal tide, but the lunar-fortnightly oscillation is well reproduced with a lag of five days and a reduction of amplitude in the ratio of approximately one to fourteen. After allowing for the direct action of the river, the well is found to be very sensitive to local rainfall during winter months. The effects of rainfall upon river-level and underground water-level appear to be in many respects closely similar.

Mr. J. Fairgrieve, M.A., read a paper entitled "Suggestions as to the Conditions precedent to the occurrence of Summer Thunderstorms, with special reference to that of June 14th, 1914." The meteorological phenomena accompanying the rainfall were put on record and the cloud distribution, the barometric pressure, the wind movements and the temperature were specially dealt with. It is evident that the clouds and the rain-fields lie in parallel belts and that the former appear some hours before the rain begins to fall. It was suggested that this belting of wind and rain must be due to rippling on a large scale, the rippling being brought about by the interaction of two currents of different temperatures. If the conditions are unstable and especially if relief also induces disturbance, thunderstorms will develop along lines of rippling and will drift with the wind. Thunderstorms have apparently three movements, a development along a belt, a sideways movement to leeward, and a spread to windward. The first may be due to rippling; the second is a drift; the third may be explained if it is granted that a local ridge of high pressure develops along the axis of the thunderstorm. The storm then breaks up into two belts of which that to leeward soon dies out, owing to the lack of a supply of rising air.

The following gentlemen were balloted for and elected Fellows of the Society:—Mr. H. Aldous, Lieut. D. Brunt, R.E., Lieut. H. Cotton, R.E., Lieut. L. B. Cundall, R.E., and Lieut.-Col. C. E. Dupuis, R.E.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE LATE Mr. D. S. SALTER.

MAY I be permitted to express my gratitude to your numerous readers who have written to me on hearing of the death of my brother, since it has been impossible for me to reply to each personally. Their sympathy has made me feel that my own sense of loss is widely shared in that the war has taken toll of another of those promising young lives on which the future of meteorology depended

CARLE SALTER.

62, Camden Square, London, N.W. 1, 4th May, 1918.

BLACK RAIN.

A BLACK RAIN is recorded in the minutes of the Philosophical Club of the Royal Society which I have recently been editing. It was described by Mr. James Rust, Minister of Slains, in Aberdeenshire, and Colonel Sykes, who made the communication, had satisfied himself of his trustworthiness. The rain fell not only at that place but also along the whole eastern coast of the county on January 14th, 1862. The morning, about 8.30 a.m., was clear, then the sky darkened, threatening rain. About an hour later, a "large, dense, black, smoky-looking cloud came driving over the sea from the S.S.E. and discharged a shower of rain, with drops like ink, which blackened all the water collected in cisterns from the roofs of houses and dirtied clothes put out to bleach, so effectively that warm water was needed to wash out the spots." Mr. Rust suggested that a recent eruption of Vesuvius might be the cause; Sir R. Murchison thought this origin impossible, because of the distance, and that it must be smoke, while Professor Tyndall stated that his own experiments made him doubtful whether a sufficient quantity of soot could have been distributed through the atmosphere to produce the blackness described.

T. G. BONNEY.

9, Scroope Terrace, Cambridge, 25th April, 1918.

VARIATIONS IN SPRING TEMPERATURE.

THE following readings afford another instance of the great and irregular changes to which our climate is subject :—

1918.	Max. temp.	Min. temp.	Range °	Mean °	Difference from average.
March 24 ..	71	36	35	53·5	+11·0
April 16 ..	39	36	3	37·5	— 9·7

Bristol, April 18th, 1918.

W. F. DENNING.

USUAL TEMPERATURE RANGE.

THE temperature range of 36°F. recorded by Mr. G. Weston, near Godalming on March 24th, was certainly remarkable, but reference to the Daily Weather Report shows that it was exceeded at both Benson and South Farnborough, as at each of these stations the range amounted to more than 40°. The figures in the Report for March 24th are :—Benson, max. 67°, min. 26° ; South Farnborough, max., 70°, min., 28°. The Benson thermograph record for the week ending on the 25th was of great interest, the regular diurnal wave growing steadily larger in amplitude as the week advanced, culminating in the range of 41° noted above. If the "meteorological day," 7 a.m. to 7 a.m. is disregarded, the range between the min. early on the 24th and the max. on the afternoon of the same day was 1° larger still, *i.e.*, 42° at Benson, and 43° at South Farnborough, and this in a period of about 12 hours, a very unusual phenomenon in this country. J. S. DINES.

66, Sydney Street, S.W. 3, April 23rd, 1918.

METEOROLOGICAL NEWS AND NOTES.

DR. H. R. MILL is steadily improving in health, after his recent accident, and is now at his home in Surrey. It may still be some time before he is able to resume his work at Camden Square.

CORPORAL H. E. CARTER, Chief Computer to the British Rainfall Organization, who had been for some time employed in the Meteorological Section of the Royal Engineers, felt it to be his duty to take a more active part in the war, and recently obtained a transfer to an infantry regiment, with which he took part in opposing the great German offensive movement of March last. We regret to learn that he was taken prisoner and sent to Germany. All those who know his enthusiastic temperament will have much sympathy with him in the misfortune that has befallen him.

MR. R. C. MOSSMAN, F.R.S.E., has been awarded the Keith Prize (which is a gold medal and a sum of money) by the Royal Society of Edinburgh, "for his work on the Meteorology of the Antarctic Regions, which originated with the important series of observations made by him during the voyage of the *Scotia* (1902-1904), and has continued to the present time. Mr. Mossman's paper 'On a See-Saw of Barometric Pressure, Temperature, and Wind Velocity between the Weddell Sea and the Ross Sea,' published in the *Proceedings* of the Society, falls within the period."

REVIEWS.

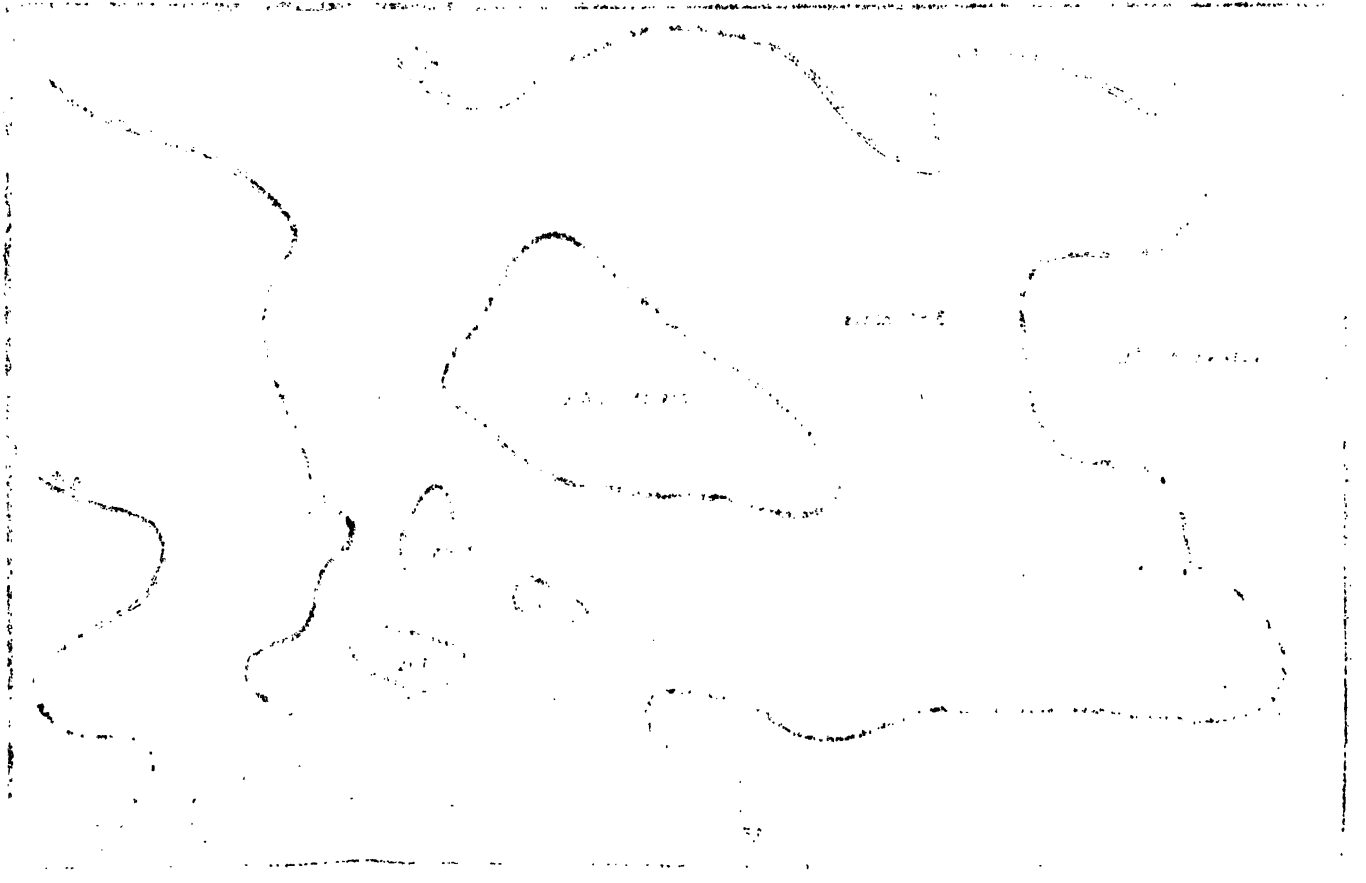
Weather Forecasting in the United States. By a Board composed of Alfred J. Henry, *Chairman*, Edward H. Bowie, Henry J. Cox, Harry C. Frankenfield. U.S. Weather Bureau (Charles F. Marvin, Chief). Washington, 1916. Size, $10\frac{1}{4} \times 7$. Pp., 370, many plates.

PROF. MARVIN, struck by the want of any formal statement of the principles of weather forecasting which could serve as a text book for students of the art, invited the forecasting staff of the United States Weather Bureau, of which he is Chief, to set out in writing the rules on which they worked. As there are six separate forecast regions in the United States each with its own expert and experienced staff, the Board which was set up to examine the essays sent in had a considerable mass of material to deal with. The result is a dozen chapters, the three first dealing with generalities, the remainder with the practical problems of forecasting as practised in America. The work is copiously illustrated by weather charts and diagrams.

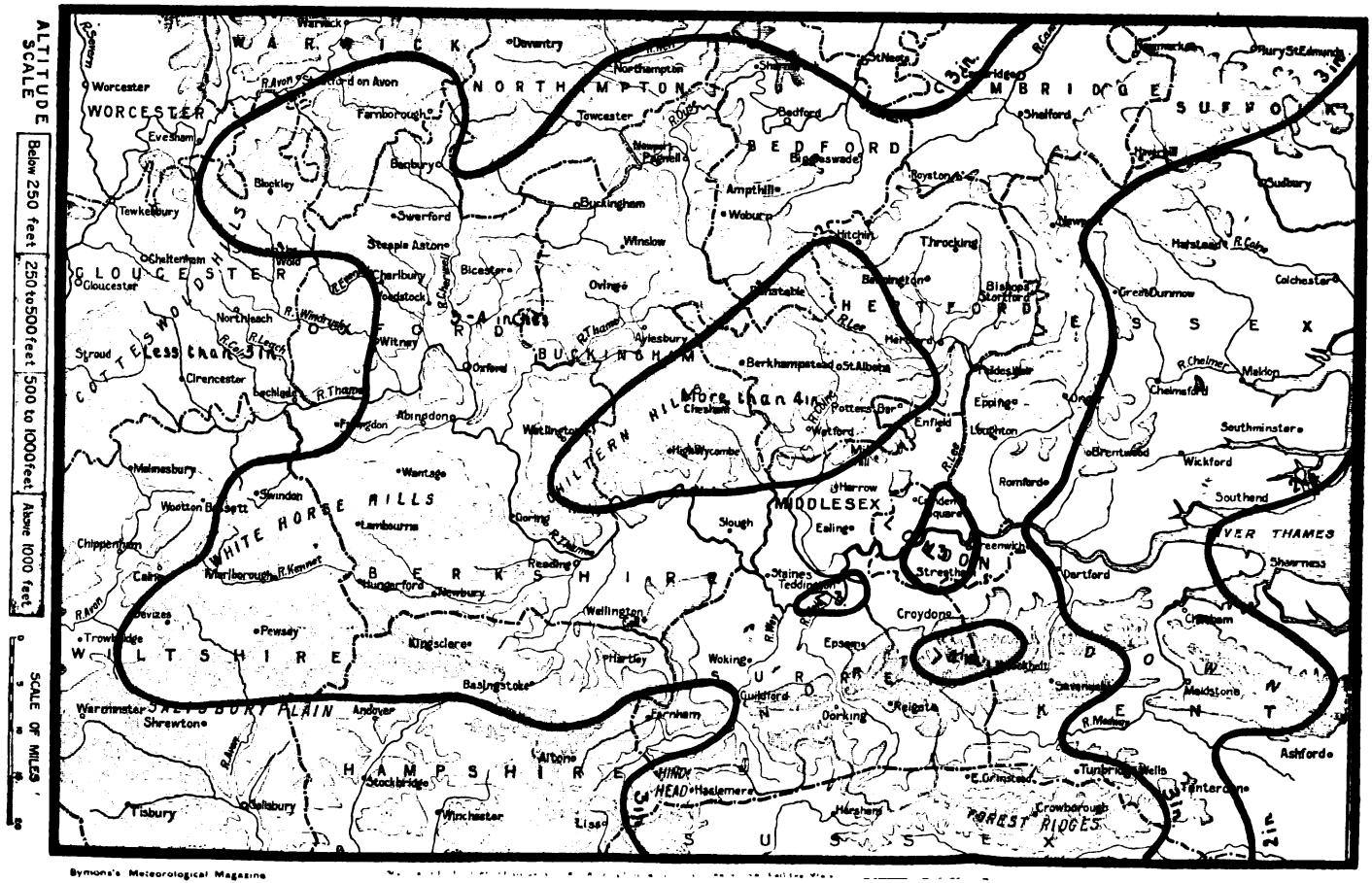
Prof. Marvin sums up thus :—"The consensus of opinion seems to be that the only road to successful forecasting lies in the practical and consistent study of the daily weather maps." The value of the book he considers is that it gives the experience of those who have gone before as a guide.

The Combination of Observations. By David Brunt, M.A., B.Sc. Cambridge, University Press. 1917. Size, $9 \times 5\frac{1}{4}$. Pp. x. + 220. Price, 8s. net.

A DIFFICULTY which frequently perplexes students of the actual phenomena of Nature is the apparent indifference of mathematicians to the quality of the Observations on which they exercise their methods. There has grown up a semi-superstitious feeling that mathematical processes have a magical purifying power which can build firm conclusions from shaky data. A useful corrective of this feeling is supplied by Mr. Brunt's valuable little book. The author keeps the limitations of his methods steadily in mind while developing the value of them by carefully worked out practical examples. The aim of the book is to give an account of the method of least squares in applying the law of errors to the treatment of observational data. Special interest attaches to the short chapters on the Weighting of Observations, the Rejection of Observations, and Correlation. An extremely important feature to the student is the bibliography which directs attention to special works dealing with each of the aspects of the subject.



THAMES VALLEY RAINFALL. APRIL, 1918.



Symons's Meteorological Magazine

THE WEATHER OF APRIL.

In an average April the mean barometric pressure over the United Kingdom is highest over Central and Southern England, and lowest in the north and west of Scotland. In the past month the normal atmospheric conditions were entirely reversed, and, as a result, the arrangement of weather in the various districts was altogether exceptional.

With the existing pressure distribution the predominant winds were naturally from some point between north and east, and over England, where the weather was influenced not infrequently by cyclonic systems which were developed over neighbouring parts of the Continent, they occasionally blew with considerable strength. The polar current would in itself have been sufficient to produce a low mean temperature, but, owing to the disturbing causes just mentioned, it was unfortunately accompanied by much cloud, and, in the eastern and south-eastern districts, by frequent rains, often of great intensity. At nearly all the English stations the total duration of sunshine for the month was below the average, and at Kew it was the smallest registered in April since the record commenced in 1881. The worst weather occurred during the third week, when the aggregate rainfall in England S.E. was equal to nearly four times, and in England E. to nearly eight times, the average. At many places in the same districts the heavy downpours of the 15th-16th, and the 19th-21st, were mingled with snow.

Over Ireland and north Britain the weather was cold and rather changeable in the earlier part of the month, with sharp frost in many places on the nights of the 2nd, 4th, 7th, and the 11th and 12th. Early on the 3rd the sheltered thermometer fell to 26°, at Markree Castle, on the 5th to 24°, at West Linton, and on the 8th to 22°, at Balmoral, and 27° at Gordon Castle. Towards the middle of the month the weather improved, and later on, when the eastern and southern districts were experiencing the worst possible conditions, the west and the north enjoyed more than a fair amount of bright sunshine. For the month as a whole Glasgow recorded a total duration of 170 hours, or 43 more than the average, and Birr Castle 193 hours, or 40 more than the average, and considerably more than twice as much as Kew.

In the closing week, when an anticyclone extended from the northward, fair weather became more general, and, under the influence of genial sunshine, the temperature reached its highest level for the month. In many parts of the United Kingdom the thermometer between the 26th and 28th rose to between 65° and 70°, and at Killarney it touched 73°.

Auroræ were observed in Scotland on the 3rd, 5th, 6th and 11th; on the last mentioned date it was also seen in the north of Ireland.

The rainfall of the month exceeded the average only in the south-east of England, where a well-marked area extending from Salisbury Plain to Norwich had more than 3 inches. More than 4 inches fell over part of the Thames Valley, where about twice the average fell in places. This renders the map of the distribution of rainfall facing this page more than usually interesting. The total fall in other parts of England and over a large part of Scotland hardly anywhere reached 2 inches. Over the greater part of Wales, and even in the wet districts of the West Highlands, not much more than 2 inches fell. In Ireland the rainfall was very uniform at between 1 and 2 inches. The general rainfall of the countries, expressed as a percentage of the average, was :— England and Wales, 106; Scotland, 49; Ireland, 56; British Isles, 74.

In London (Camden Square), the mean temperature was 45°·2, or 2°·9 below the average of 50 years. The duration of bright sunshine was, 75·3 hours, and the duration of rainfall, 72·1 hours. Evaporation, ·89 in.

RAINFALL TABLE FOR APRIL, 1918.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875–1909. in.	1918. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	1·74	3·24	+1·50	148	·89	15	20
Tenterden	*Kent*	1·77	1·23	— ·54	70	·20	20	15
Arundel (Patching)	*Sussex*	1·82	2·64	+ ·82	146	·66	20	16
Fordingbridge (Oaklands)	*Hampshire*	1·92	2·29	+ ·37	119	·52	15	14
Oxford (Magdalen College)	*Oxfordshire*	1·67	3·27	+1·66	196	·95	15	18
Wellingborough (Swanspool)	*Northampn*	1·78	2·82	+1·04	159	·56	20	17
Bury St. Edmunds (Westley)	*Suffolk*	1·62	3·70	+2·08	129	1·71	15	17
Geldeston [Beccles]	*Norfolk*	1·55	3·48	+1·93	124	1·85	15	12
Polapit Tamar [Launceston]	*Devon*	2·34	2·53	+ ·19	108	·51	16	15
Rousdon [Lyme Regis]	,,	2·39	1·82	— ·57	76	·33	10	17
Stroud (Field Place)	*Gloucester*	2·09	2·30	+ ·21	111	·60	16	15
Church Stretton (Wolstaston)	*Shropshire*	2·20	1·56	— ·64	71	·30	21	12
Boston	*Lincoln*	1·57	1·74	+ ·17	111	·56	15	21
Worksop (Hodsock Priory)	*Nottingham*	1·62	1·49	— ·13	92	·45	6	16
Mickleover Manor	*Derbyshire*	1·77	1·20	— ·57	68	·26	6	13
Buxton	,,	2·87	2·15	— ·72	75	·59	7	12
Southport (Hesketh Park)	*Lancashire*	1·84	1·04	— ·80	57	·24	6	13
Arncliffe Vicarage	*York, W.R.*	3·73	...	...	...	...	...	...
Wetherby (Ribston Hall)	,, ,,	1·85	1·35	— ·50	73	·35	6	9
Hull (Pearson Park)	,, *E.R.*	1·69	1·44	— ·25	35	·36	6	20
Newcastle (Town Moor)	*North'land*	1·84	1·44	— ·40	78	·35	20	15
Borrowdale (Seathwaite)	*Cumberland*	6·91	...	...	...	...	...	...
Cardiff (Ely)	*Glamorgan*	2·50	2·17	— ·33	87	·50	9	18
Haverfordwest	*Pembroke*	2·82	2·09	— ·73	75	·63	25	13
Aberystwyth (Gogerddan)	*Cardigan*	2·48	1·28	—1·20	52	·44	5	9
Llandudno	*Carnarvon*	1·79	1·06	— ·73	60	·29	6	10
Cargen [Dumfries]	*Kirkcudbrt.*	2·50	·69	—1·81	28	·24	25	4
Marchmont House	*Berwick*	2·28	·93	—1·35	41	·15	2	14
Girvan (Pinmore)	*Ayr*	2·81	·80	—2·01	29	·23	9	10
Glasgow (Queen's Park)	*Renfrew*	1·86	·44	—1·42	24	·15	6	9
Islay (Eallabus)	*Argyll*	2·64	2·27	— ·37	86	·87	8	11
Mull (Quinish)	,,	2·98	2·26	— ·72	76	·84	8	12
Balquhidder (Stronvar)	*Perth*	4·15	...	—	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	1·93	·88	—1·05	46	·27	19	8
Braemar	*Aberdeen*	2·30	1·03	—1·27	45	·31	1	8
Aberdeen (Cranford)	,,	2·23	·36	—1·87	16	·14	19	10
Gordon Castle	*Moray*	1·74	1·71	— ·03	99	·59	19	12
Drumnadrochit	*Inverness*	1·85	1·41	— ·44	77	·52	19	11
Fort William	,,	3·65	1·34	—2·31	37	·59	5	9
Loch Torridon (Bendamph)	*Ross*	4·70	2·26	—2·44	48	·55	5	10
Dunrobin Castle	*Sutherland*	2·02	1·04	— ·98	52	·45	8	4
Killarney (District Asylum)	*Kerry*	3·46	1·45	—2·01	42	·27	7, 9	17
Waterford (Brook Lodge)	*Waterford*	2·68	1·70	— ·98	64	·65	8	10
Nenagh (Castle Lough)	*Tipperary*	2·54	·79	—1·75	31	·21	8	8
Ennistymon House	*Clare*	2·81	1·23	—1·58	44	·47	8	11
Gorey (Courtown House)	*Wexford*	2·37	1·83	— ·54	77	·37	9	12
Abbey Leix (Blandsfort)	*Queen's Co.*	2·54	1·52	—1·02	60	·52	8	10
Dublin (Fitz William Square)	*Dublin*	2·03	1·87	— ·16	94	·49	9	11
Mullingar (Belvedere)	*Westmeath*	2·37	1·76	— ·61	75	·58	8	9
Crossmolina (Enniscoe)	*Mayo*	3·13	1·47	—1·66	47	·29	8	11
Cong (The Glebe)	,,	2·98	1·01	—1·97	34	·21	5	10
Collooney (Markree Obsy.)	*Sligo*	2·52	1·18	—1·34	47	·33	8	10
Seaforde	*Down*	2·76	1·21	—1·55	44	·47	8	9
Ballymena (Harryville)	*Antrim*	2·57	1·89	— ·68	76	·68	8	10
Omagh (Edenfel)	*Tyrone*	2·50	1·40	—1·10	56	·43	8	9

SUPPLEMENTARY RAINFALL, APRIL, 1918.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road .	4·84	XI.	Lligwy	1·16
,,	Ramsgate.....	1·32	,,	Douglas, Isle of Man	1·77
,,	Hailsham	3·31	XII.	Stoneykirk, Ardwell House...	1·08
,,	Totland Bay, Aston House...	1·74	,,	Carsphairn, Shiel.....	1·88
,,	Stockbridge, Ashley..	3·04	,,	Langholm, Drove Road	1·00
,,	Grayshott.....	3·36	XIII.	Selkirk, The Hangingshaw..	·65
III.	Harrow Weald, Hill House...	3·89	,,	North Berwick Reservoir.....	·62
,,	Pitsford, Sedgebrook.....	2·38	,,	Edinburgh, Royal Observaty.	·62
,,	Woburn, Milton Bryant.....	3·60	XIV.	Biggar.....	·55
,,	Chatteris, The Priory.....	2·43	,,	Maybole, Knockdon Farm ...	·48
IV.	Elsenham, Gaunts End	3·03	XV.	Buchlyvie, The Manse.....	·98
,,	Shoeburyness	1·84	,,	Ardgour House	1·62
,,	Colchester, Hill Ho., Lexden	2·08	,,	Oban.....	1·52
,,	Ipswich, Rookwood, Copdock	2·47	,,	Campbeltown, Witchburn ..	1·17
,,	Aylsham, Rippon Hall..... ..	2·95	,,	Holy Loch, Ardnadam.....	1·79
,,	Swaffham	2·12	,,	Tiree, Cornaigmore	...
V.	Bishops Cannings	3·76	XVI.	Glenquey	1·60
,,	Weymouth.....	1·35	,,	Glenlyon, Meggernie Castle..	...
,,	Ashburton, Druid House.....	2·92	,,	Blair Atholl	·74
,,	Cullompton	2·10	,,	Coupar Angus	·87
,,	Lynmouth, Rock House	2·59	,,	Montrose, Sunnyside Asylum.	·40
,,	Okehampton, Oaklands.....	2·86	XVII.	Balmoral	·86
,,	Hartland Abbey.....	1·82	,,	Fyvie Castle	1·00
,,	St. Austell, Trevarna	2·63	,,	Keith Station	2·28
,,	North Cadbury Rectory.....	1·88	XVIII.	Rothiemurchus	1·63
VI.	Clifton, Stoke Bishop	2·38	,,	Loch Quoich, Loan	4·20
,,	Ledbury, Underdown..... ..	2·71	,,	Skye, Dunvegan	2·69
,,	Shifnal, Hatton Grange.....	2·33	,,	Fortrose.....	·81
,,	Droitwich.....	2·56	,,	Glencarron Lodge	2·47
,,	Blockley, Upton Wold.....	3·68	XIX.	Tongue Manse	2·26
VII.	Grantham, Saltersford.....	2·05	,,	Melvich	1·30
,,	Market Rasen	...	,,	Loch More, Achfary	3·03
,,	Bawtry, Hesley Hall	1·36	XX.	Dunmanway, The Rectory ..	1·96
,,	Whaley Bridge, Mosley Hall	1·70	,,	Glanmire, Lota Lodge.....	1·57
,,	Derby, Midland Railway.....	1·33	,,	Mitchelstown Castle.....	1·57
VIII.	Nantwich, Dorfold Hall	1·22	,,	Darrynane Abbey.....	2·37
,,	Bolton, Queen's Park	1·06	,,	Clonmel, Bruce Villa	1·51
,,	Lancaster, Strathspey	1·11	,,	Broadford, Hurdlestown.....	1·19
IX.	Langsett Moor, Up. Midhope	1·33	XXI.	Enniscorthy, Ballyhyland...	1·87
,,	Scarborough, Scalby	2·06	,,	Rathnew, Clonmannon	1·77
,,	Ingleby Greenhow	1·84	,,	Ballycumber, Moorock Lodge	1·00
,,	Mickleton	·70	,,	Balbriggan, Ardgillan	1·56
X.	Bellingham, High Green Manor	·96	,,	Castle Forbes Gardens.....	1·22
,,	Ilderton, Lilburn Cottage ...	1·17	XXII.	Ballynahinch Castle.....	1·28
,,	Keswick, The Bank.....	1·39	,,	Woodlawn	·98
XI.	Llanfrechfa Grange	2·50	,,	Westport, St. Helens	1·36
,,	Treherbert, Tyn-y-waun	3·27	,,	Dugort, Slievemore Hotel ...	1·12
,,	Carmarthen, The Friary	2·38	XXIII.	Enniskillen, Portora.....	1·35
,,	Fishguard, Goodwick Station.	1·27	,,	Dartrey [Cootehill]	1·48
,,	Crickhowell, Tal-y-maes.....	6·50	,,	Warrenpoint, Manor House ..	1·26
,,	New Radnor, Ednol	2·62	,,	Belfast, Cave Hill Road	1·56
,,	Birmingham WW., Tyrmynydd	2·02	,,	Glenarm Castle	1·25
,,	Lake Vyrnwy	2·24	,,	Londonderry, Creggan Res...	2·15
,,	Llangynhafal, Plas Drâw.....	2·18	,,	Dunfanaghy, Horn Head ...	...
,,	Rhwibryfdir	3·44	,,	Killybegs	1·50
,,	Dolgelly, Bryntirion.....	2·24			

Climatological Table for the British Empire, November, 1917.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	58·8	21	30·9	26	52·1	41·8	43·0	88	89·7	26·9	1·82	15	7·5
Malta	72·1	11	52·7	17	64·8	58·0	...	81	119·0	45·0	3·44	16	0·4
Lagos	95.0	18	70·0	15	88·2	84·0	74·8	77	154·4	69·0	2·63	7	7·3
Cape Town	89·4	21	45·1	26	72·6	55·6	52·8	67	...	...	·78	9	4·2
Johannesburg	84·4	1	39·0	20	70·8	51·3	52·1	77	...	37·0	17·76	20	6·1
Mauritius	80·2	17	61·2	1	78·6	66·6	63·1	74	...	57·7	2·97	20	6·2
Bloemfontein	90·2	2	45·3	18	79·8	51·7	49·3	53	..	...	2·82	9	4·2
Calcutta...	86·6	12	58·0	20	82·0	66·4	65·1	75	...	49·0	·40	1	2·2
Bombay...	87·3	29	69·5	12	85·4	72·0	68·0	71	139·5	61·0	·00	0	1·4
Madras	89·5	4	70·2	30	85·0	74·3	72·2	82	159·5	66·6	6·03	17	6·2
Colombo, Ceylon ...	87·9	7	69·6	2, 4	84·8	73·6	71·7	82	158·2	62·0	11·04	19	7·4
Hongkong	82·9	2	57·1	21	72·7	64·7	54·8	60	...	...	·10	1	5·6
Sydney	82·8	15	52·0	19	71·7	58·9	56·1	68	145·7	46·0	8·35	18	7·0
Melbourne	84·5	29	43·3	6	69·6	52·8	50·3	67	147·0	35·4	4·18	16	6·4
Adelaide	89·0	2	43·9	13	75·2	54·1	47·9	55	157·0	35·1	1·15	11	5·1
Perth	96·0	26	48·4	4	75·3	56·6	51·3	58	156·4	38·0	·02	1	2·9
Coolgardie	98·2	2	45·0	6, 16	81·8	54·2	43·3	35	155·0	41·0	1·40	2	2·0
Hobart, Tasmania ...	84·0	4	40·0	6	66·4	49·3	47·5	67	148·3	33·1	2·50	20	6·4
Wellington	70·9	30	45·5	25	64·7	52·0	51·1	77	150·0	30·0	1·79	4	5·3
Jamaica, Kingston ...	89·7	29	68·0	3	85·0	71·2	69·6	82	...	...	·66	9	6·7
Grenada	88·0	9	70·0	1,3,4	84·0	73·1	...	76	139·0	...	6·54	12	4·0
Toronto	54·5	10	10·1	25	41·8	27·1	27·5	80	104·8	6·6	1·27	10	...
Fredericton	50·8	5	—5·0	28	36·3	20·8	23·7	82	...	...	2·33	7	5·8
St. John, N.B. ...	51·3	6	5·5	28	37·0	25·8	25·2	74	111·5	4·2	3·36	11	5·7
Victoria, B.C.	61·2	10	36·6	25	52·3	36·6	44·0	89	117·0	30·8	2·28	19	7·4

Johannesburg.—Bright sunshine 233·°7 hours. Rainfall a record for November.

COLOMBO, CEYLON.—Mean temp. 79°·2, or 0°·3 below, dew point 1°·1 below, and R ·49 in. below, averages. Mean hourly velocity of wind 4·5 miles.

HONGKONG.—Mean temp. 68°·2. Bright sunshine 189·2 hours. Mean hourly velocity of wind 12·5 miles.

Sydney.—A very wet month, R 5·53 in. above average and not surpassed since November, 1873, when 9·45 in. was recorded.

Melbourne.—Mean temp. 0°·1 above, and R 1·94 in. above, averages.

Adelaide.—Mean temp. 2°·3 below, and R ·02 in. below, averages.

Coolgardie.—Mean temp. 2°·9 below, average, and R ·75 above, averages.

Hobart.—Mean temp. slightly above, average, and rainfall normal.

Wellington.—Bright sunshine, 244·4 hours. Mean temp. 1°·4 below.

Symons's
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THE METEOROLOGICAL OFFICE.

We have received the following intimation from Sir Napier Shaw, under date of May 23rd, 1918 :—

The Lords Commissioners of His Majesty's Treasury have been pleased to approve the proposal of the Meteorological Committee that in view of the variety and importance of the scientific problems upon which the Meteorological Office is required to advise the fighting forces, Sir Napier Shaw, F.R.S., shall, for the period of the war, become scientific adviser to his Majesty's Government in Meteorology, being relieved of the administrative duties of the Meteorological Office but retaining the Chairmanship of the Meteorological Committee, Lieut.-Col. H. G. Lyons, R.E., F.R.S., with the sanction of the War Office, being appointed Acting Director of the Meteorological Office for the same period.

ROYAL METEOROLOGICAL SOCIETY.

A meeting of the Society was held on Wednesday, May 15th, at 70, Victoria Street, S.W., Sir Napier Shaw, F.R.S., President, in the Chair.

Mr. C. E. P. Brooks, M.Sc. read a paper, entitled : "Continentality and Temperature, Second Paper." The first part dealt with the variation with latitude of the coefficients which give the influence of land on temperature, land east, land west and ice being considered separately, and it was found that in the tropics the coefficients are uniformly small. In the temperate regions in winter the effect of land to the east is also small, but land to the west has a well-marked effect in lowering temperature ; this effect increases towards the poles. In summer land both east and west increases temperature. In the second part the temperatures of land and water hemispheres were calculated. The distribution of land and sea at the beginning of the Great Ice Age was reconstructed from geological data, and on applying the calculated formulae to this changed distribution it was found that the temperature must have been lower than the present in different districts by various

amounts up to 20°C. in January and 15°C. in July. These changes agreed very closely with those required by geologists and palæontologists, and it was further proved that the glacial period was a necessary consequence of the geographical changes. Finally a theory of climatic evolution was outlined in accordance with these ideas, and the theory of isostasy.

The report on Phenological Observations in the British Isles during 1917 was presented by Mr. J. Edmund Clark and Mr. H. B. Adames. The persistent winter, hardly broken over four and a half months from early December, dominated seasonal conditions. The temperature from December to April showed in England, S.W., a deficiency of 4°·8 F., ranging to 1°·2 in Scotland, N. In the southern half of our islands the 125 days to mid-April were cold almost beyond precedent in the previous hundred years, farm and garden prospects being therefore of the gloomiest. By the end of spring there was a complete change. Absence of keen winds and frosts favoured the belated blossoming, and by June flowering dates were normal, although the early spring flowers, anemone and blackthorn, had been twenty and twenty-four days late. From the time of the dog rose, dates were actually early. Finally, the chief practical result of the cold was indirect, the heavy destruction of bird life favouring tree blight and caterpillars, the ova of which had been preserved by the cold. In many parts caterpillars stripped fruit trees and ruined garden greens. The antler caterpillar plague in Derbyshire was ascribed mainly to the scarcity of rooks. On the other hand berries and other fruits suffered little from birds. From late July into September the splendid harvest prospects were much marred by rain, wind and lack of sun. Final results were better than in 1916, although grain crops fell about 5 per cent below the ten-year average in England. As to roots, a warm, dry November more than made up for the cold, wet October, and potatoes gave a record crop with 8,600,000 tons off 1,364,000 acres, compared with 5,468,000 off 1,134,400 in 1916. Tree fruits were excellent, the August gales proving prejudicial to apples only. November gave a splendid send-off for the coming year in the exceptionally favoured winter earring of the grain crops. Table V. of the Report gave the yearly floral means for the five chief districts from 1891. That year alone was later than 1917, namely, 9·6 days against 7·6, after the mean flowering date, May 17·4. Birds and insects, in Table VI., confirmed the lateness of 1917, averaging 6 and 12 days behind, whilst Table VII., of 24 migrants, showed nearly 10 days lag behind a 20-year mean, 1877-1896.

The following candidates were balloted for and elected Fellows of the Society :—Sir J. Benton, K.C.I.E., Mr. J. Fairgrieve, M.A. Capt. E. H. D. Nicholls, Director of Public Works, Cyprus, Mr. W. Norbury, and Ensigns J. D. Anderson, A. B. Leonard and W. P. Prien, of the U.S. Naval Reserve Force.

INVERSE WEATHER PHENOMENA.

(Concluded.)

By L. C. W. Bonacina.

There is one more feature to be discussed in this article, namely, the true inverse of snowstorms. It was demonstrated at the beginning that the seasonal antithesis between snowstorms and thunderstoms is less complete than between gales and thunderstorms inasmuch as the highest monthly snowfall frequencies overlap into the thunder season in April and fall short of the commencement of the common gale and fog season in October; and when the physical processes involved are examined, one finds in accordance with the seasonal hint, a correspondingly weaker case of inversion.

But, remembering that the snow season embraces both the winter solstice, November to February, and the spring equinox, March and April, if one looks at the opposite period of the summer solstice, May to August, and the autumnal equinox, September and October, taken together, can any feature of the rainfall of the warmer months be discovered which, on the basis of determining conditions, can be regarded as an inverse weather phenomenon to snowfall? Now precipitation in the colder months is, so far as the temperature effect is concerned, less intense than in the warmer months, and this is the reason why individual summer downpours tend *cæteris paribus* to be heavier than winter rainfalls and, *a fortiori*, snowfalls. In fact as a simple temperature effect it would be true to regard the heavy character of showers and rainstorms in summer and autumn as the inverse climatic feature of snow showers or storms in winter and spring. In this case it is merely the striking physical appearance of the frozen form of precipitation in a land where the liquid form is more prevalent that renders the winter one of the inversely related pair the more conspicuous; but *heavy* rain is as much characteristic of the warmer months of the year as snow is of the colder.

In this connection it is important to guard against a rather prevalent error among meteorologists of confusing heavy summer rainstorms as such with thunderstorms. Probably not more than a quarter of the number of heavy summer downpours are occasioned by thunderstorms in the real sense, and not more than half could be called thunderstorms in even a secondary sense. The true thunder or electrical disturbance is a highly distinctive phenomenon; but many of the heavy rainstorms of summer in association with the passage of small cyclonic depressions are not accompanied by thunder and lightning at all. The great Norwich rainstorm at the end of August, 1912, was in no sense a thunderstorm, and the great rainstorm of the night of June 28th, 1917, was not in a primary sense a thunderstorm, the electrical disturbance being but feeble

and occasional. But the great London rainfall of June 16th, 1917, on the contrary, was brought by a thunderstorm in the fullest sense of the term. The importance of distinguishing between summer thunderstorms and rainstorms in regard to the inverse phenomena under discussion is this : thunderstorms are, as has been pointed out, mainly solstitial phenomena (May to August), but showers or rains of a high degree of intensity but without electrical disturbance continue to characterize the period of the autumnal equinox, September and October. The reason is that heavy rain, which indicates high absolute humidity is simply favoured by the high air temperature which exists in autumn in consequence of the atmosphere's accumulated store of warmth ; but thunderstorms, on the other hand, require for their full violence not only a high air temperature but also the direct heating effects of powerful radiation, and this combination can only be had during the solstitial or midsummer period. The contrast in this respect between the month of May with its violent electrical storms generated by the shaft-like force of the sun's rays, and the month of September, with its heavy rain showers, but fewer and less powerful electrical disturbances, is a feature that can hardly fail to have struck the majority of climatic observers. In July thunderstorms and simple rainstorms are both very prominent ; but the super-imposition of the thunderstorms on the more general rainfalls, which are more common than in the drier month of May, seems *ipso facto* to have the effect of often rendering the thunderstorms of the later or hotter part of the season less severe on the *electrical* side than those which mark the earlier and cooler part when thunderstorms are bred with special facility by the first heat of the year.

REVIEW.

Twelfth Annual Report of the Meteorological Committee. For the Year ended March 31st, 1917 (62nd year of the Meteorological Office). Published by H.M. Stationery Office, 1917. Size, 9½ × 6. Pp., 16. Price, 1d.

The twelfth Annual Report of the Meteorological Committee has dwindled to a mere shadow of its predecessors, but bears evidence that the work of the Meteorological Office has increased in an inverse ratio. One of the new activities mentioned consists in the taking over of the responsibility for the Committee on the Investigation of Atmospheric Pollution. A large number of the regular staff of the Office are absent on war duties, many of them being engaged in the Meteorological Section of the Royal Engineers under Major E. Gold, D.S.O. The Meteorological Office has also undertaken the training of a number of outside candidates for this service.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE HEAT AND THUNDERSTORMS OF MAY.

THE month of May, 1918, was very true to type, the first half being cool, with an occasional suspicion of sultriness in the afternoons, and the second half full summer. The first advance of the summer in May is always an impressive phase of climate, and this year it took the form between the 15th and 22nd of an unbroken spell of sustained warmth during which the rich tones of the sky and the refulgence of the new foliage in the fierce solar rays were magnificent. As is invariably the case in early summer such conditions meant electrical disturbance, and in the London district violent thunderstorms occurred on the 17th and 22nd. The first indications of the evening storm of the 22nd were apparent on the 21st, and it often happens that heat thunderstorms take a couple of days to develop. Thus thundery-looking cumulus on the afternoon of the 21st died down at dusk, and it only wanted another day's heat for the storms to burst the following evening. In the Hampstead district considerable damage was done both on the 17th and 22nd, and on the latter occasion ball lighting is reported to have been seen. The ordinary flashes on the 22nd were of blinding intensity and were followed on more than one occasion by instantaneous crashes. There was rather more general wind motion during the storm of the 22nd than is usual in heat thunderstorms. The year 1918 serves to confirm my impression that the month of May is the most constant in character, and in some ways the best and most reliable of the summer months. How often does June fall back on May !

L. C. W. BONACINA.

Hampstead, June 4th, 1918.

A VIOLENT thunderstorm was experienced in this district on May 17th. Thunder was first heard about 1.30 p.m.; the storm broke at 3.30 and continued practically without interruption until 7 p.m. Two or three storms seemed to meet in this neighbourhood after working round and round for a considerable time. At one time there was lightning every five seconds and consequently there was a continuous uproar as if there were violent gunfire taking place in the sky. The rainfall may without exaggeration be described as terrific. The ground floors and basements of houses were flooded out, roads torn up and rendered impassable owing to rushing torrents of water. Serious damage was done to the allotments and crops in general. At Steppingley hailstones the size of marbles fell to the depth of three to four inches, unless my informant was exaggerating.

R. A. S. MACKENZIE.

The Hawthorns, Flitwick, Beds., May 25th, 1918.

THE heaviest thunderstorm since August, 1879, broke over this village and district this afternoon. Peals of thunder began about 2 p.m., but there was no rainfall worth mentioning till 4 p.m. Rain then came down in torrents, lightning very vivid and thunder claps deafening. About 4.30 there was much hail, the stones being very large, but this was not so noticeable at my end of the village as near the church; the deluge of rain and hail there must have been much heavier than where I live, as some two hours later the hail stones were lying by the road side several inches thick, and we had none to be seen. At 4.45 there was a slight abatement, but from 5 to 5.30 the rain came down in sheets and the thunder returned and was more terrific than ever. Rain continued till about 6.30. Total fall, 3·07 in., quite a record here, the nearest approach to it for a single storm being ·57 in. in 35 minutes, on July 19th, 1903.

So far as I can gather it was very local, as no rain fell beyond Woburn, two miles north-west, or beyond Harlington, four miles east, and it did not reach Dunstable, which is six miles south-east.

CHARLES J. KILBY.

Milton Bryan, Woburn, Beds., May 17th, 1918.

AN extraordinary hail storm occurred here soon after 3 p.m. on May 17th. The morning had been hot and sunny—maximum, 75°·1. Shortly before 3 p.m, it clouded over and a violent thunderstorm occurred accompanied first by hail, and then by rain. By 4 p,m. it was quite bright again. I have seen larger hailstones on the Himalayas, but never any approaching their size in Great Britain. The stones were literally the size of very large marbles. The hail only fell quite locally, the villages on either side not getting any. The rain measured ·39 in. My solar thermometer was smashed to pieces.

C. J. BROMHEAD.

Plâs Draw, Ruthin, North Wales, May 20th, 1918.

SNOW IN ALGIERS.

I HAVE received a letter from Algiers from Rev. E. Arkwright, whose villa is about 400 ft. above sea level, and three-quarters of a mile, as the crow flies, from the innermost part of the bay of Algiers. The position may be described as a little way up the back of an armchair that is set looking N.E., *i.e.*, with higher ground near by to S.E. and to N.W. and higher still immediately to S.W.

He writes of a snow such as in forty-five years there he never has known. Certainly in my thirteen years there, from 1875 to 1889, there was nothing like it. His letter, of December 28th, 1917 says:

> "Yesterday morning snow lay apparently 12 inches deep over everything, a most lovely soft covering, and on every twig was a load of three or four inches! Our rain is also a record. Since the summer, we have had 21·17 in. It was 17·77 in. in 1916, and 18·60 in. in 1915, and both seemed to beat the record. *P.S.*—29th.—Ice on the ponds."

In my time I saw snow flakes occasionally, and snow lying only once, about an inch deep. I do not think that I ever saw ice on water more than a few inches deep. My friend does not say in what months the rain fell. It is generally almost entirely in October, November and December, especially in December.

H. A. BOYS.

North Cadbury Rectory, Somerset, January 9th, 1918.

MOUNTAIN MISTS AND WATER SUPPLY.

In the Spanish forestry journal, *Amigos del Arbol*, for January, 1918, Dr. Perez, of Tenerife, discusses the precipitation of water from mountain mists by means of forests. He points out that the mist or cloud collected over Table Mountain, south of Cape Town, which is compared by travellers to a table cloth, forms more abundantly in the summer or rainless months when the south-east wind blows harder. He cites Dr. Marloth's experiments with two rain gauges, one representing the forest by having a series of rods rising from the funnel, the other an ordinary gauge, as described in the *Transactions of the South African Philosophical Society*, vols. 14 and 16. From December, 1902, to February, 1903, nearly 80 inches (2 metres) of water was collected in the rain gauge representing the forest and very little in the other.

In the Canary Islands the north-east Trade winds bring about the formation of a similar belt of clouds between, say, 2,000 and 5,000 feet altitude, where the evergreen forest of the Atlantic Islands grows best, and amongst them a laurel, called *Til*, which was undoubtedly the famous *Garoe* or *Holy Tree* of the Island of Ferro, which actually supplied that fountainless island with drinking water for the inhabitants until a storm blew it down. Anyone who has gone through a forest in the Canaries covered with mist can bear witness as to how much water is condensed by the foliage where trees grow. What creditable historians relate about the holy tree of Ferro is not a miracle but a scientific fact which has been proved at a similar altitude on Table Mountain, near Cape Town, under similar circumstances, and this fact should never be forgotten by those who undertake a campaign in favour of covering arid mountains by forests and thus utilizing the mountain mists in suitable localities.

We may add that the power of trees to cause the small spherules of mist to coalesce into rain-drops and drip in a steady stream to the ground is familiar to everyone who walks through an English wood during a winter mist. We have repeatedly noticed that on a misty day the road running through a forest is dry and even dusty, while the ground under the trees on either side is saturated with water, and the falling drops produce the familiar sound of a steady shower in still weather.

METEOROLOGICAL OBSERVATIONS AT LU-KIA-PANG, CHINA, FOR 1917.

By Rev. J. De Moidrey, S.J.

I.—*Barometric Pressure. Millibars.*

	8 a.m.	2 p.m.	8 p.m.	Daily Mean.
Jan.....	1030·3	1028·1	1029·4	1029·4
Feb.	24·7	22·8	23·9	23·9
Mar.	23·7	21·8	22·6	22·7
April ...	14·2	12·6	13·3	13·3
May.....	11·3	09·8	10·3	10·4
June	05·8	04·9	05·3	05·2
July	*05·4*	*04·4*	*04·6*	*04·7*
Aug.	05·8	04·5	05·3	05·1
Sept. ...	12·3	11·0	12·2	11·8
Oct.	19·2	17·1	18·5	18·2
Nov. ...	30·0	24·1	25·3	25·1
Dec.	26·7	24·6	25·8	25·7
Year	1017·1	1015·5	1016·4	1016·3

IV.—*Mean amount of Cloud.*

Jan.	*3·7*
Feb.	5·5
Mar.	5·9
April	7·4
May	5·9
June	8·3
July	7·8
Aug.	5·7
Sept.	6·6
Oct.	5·9
Nov.	5·3
Dec.	3·9
Year	6·0

V.—*Days with Thunder-storms.*

Jan.	—
Feb.	—
Mar.	—
April	—
May	1*a*
June	4
July	4
Aug.	6
Sept.	1*b*
Oct.	—
Nov.	—
Dec.	—
Year	16

a First, May 3. *b* Last, September 16.

II.—*Temperature. Degrees Centigrade.*

	MEAN DAILY.			MINIMUM.			
	Mean.	Lowest.	Highest.	Mean.	Hour A.M. h.	min.	Lowest.	Highest.
	°	°	°	°	h.	min.	°	°
Jan.	*—0·2*	*—6·8*	+4·2	*—4·1*	5	30	*—10·5*	+3·1
Feb.....	+3·4	—2·2	9·2	—0·8	4	45	—6·3	6·5
Mar.	7·1	+1·2	13·7	+2·8	4	35	—3·8	9·2
April	14·4	10·8	18·8	9·7	3	45	+5·7	12·9
May.....	18·7	11·4	25·6	13·3	4	5	8·6	18·8
June	23·9	18·1	31·2	20·8	3	50	15·7	26·8
July	27·3	21·8	32·1	24·6	4	50	19·3	27·8
Aug.	27·2	24·4	30·9	23·7	3	20	19·9	26·5
Sept. ...	23·9	19·1	29·2	21·0	4	5	19·1	26·0
Oct.	17·2	11·5	19·7	13·4	4	10	6·1	17·4
Nov.	9·5	4·6	15·1	5·7	5	5	0·6	13·7
Dec.....	2·3	—6·0	11·4	—1·0	4	50	—8·8	10·9
Year	14·6	—6·8*c*	32·1*d*	10·8	4	30	—10·5*c*	27·8*e*

Latest frost, March 24th (—0°·2); earliest, December 10th (—0°·8).

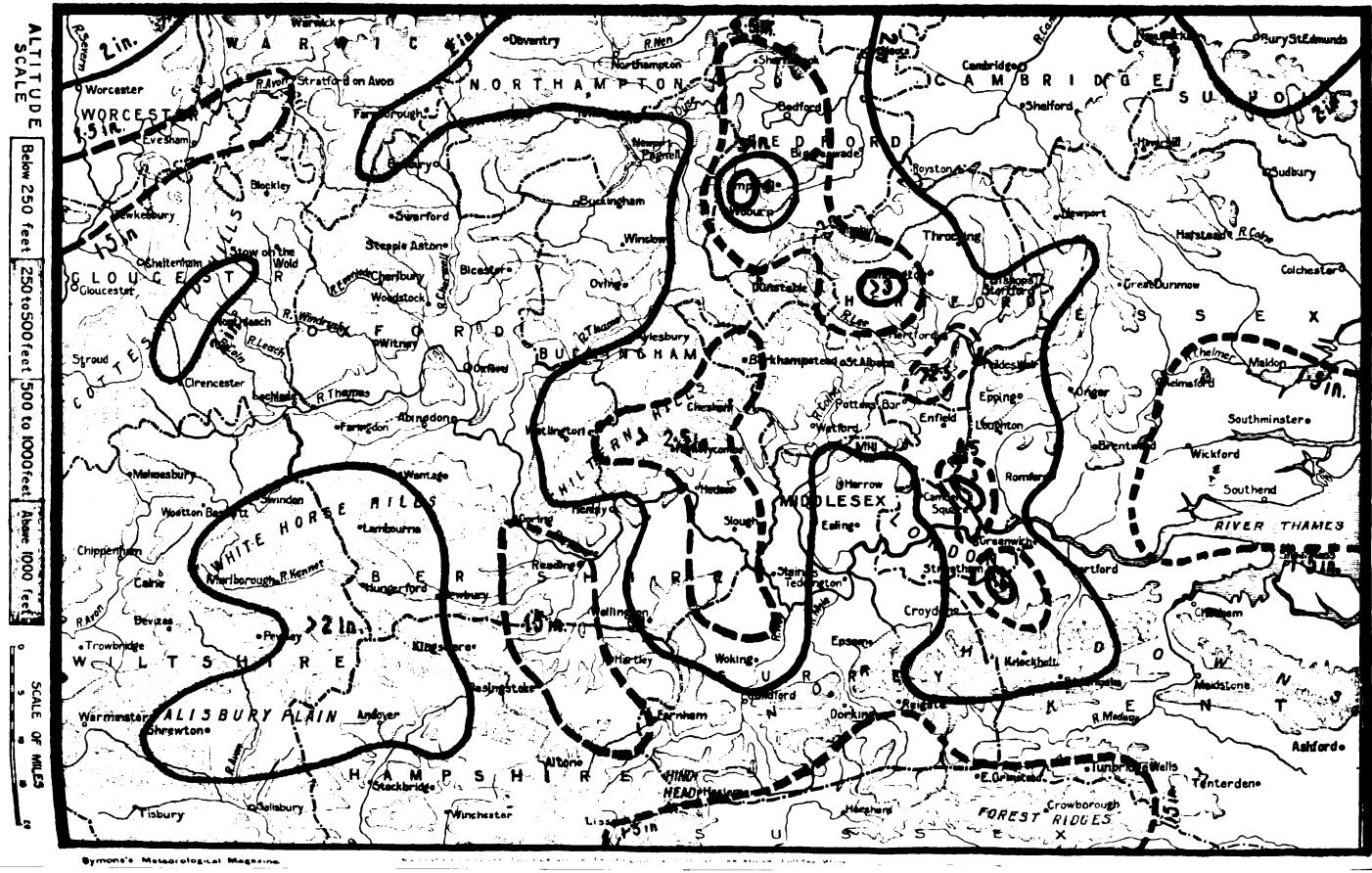
II.—(*con.*)

	MAXIMUM.				RANGE.		
	Mean.	Hour, P.M. h.	m.	Lowest.	Highest.	Mean.	Lowest	Highest.
	°	h.	m.	°	°	°	°	°
Jan.	*+4·9*	13	35	*—3·4*	+11·6	9·0	*1·6*	14·7
Feb.....	9·3	13	50	+1·1	19·8	10·1	2·6	19·1
Mar.	12·6	13	45	4·7	23·5	9·8	1·7	18·5
April	20·8	13	50	11·8	29·3	11·4	2·6	19·3
May.....	25·4	14	5	13·2	34·8	12·2	3·8	20·0
June ...	28·0	14	5	20·1	36,3	7·2	*1·6*	15·1
July.....	30·8	13	30	23·8	36·5	6·3	2·2	9·8
Aug.	32·3	13	50	26·8	36·8	8·6	2·6	11·3
Sept.	28·6	13	10	23·8	34·2	7·6	2·1	12·4
Oct.	22·9	12	50	15·2	26·8	9·4	2·5	15·2
Nov.	14·8	13	20	9·9	20·2	9·2	2·3	15·0
Dec.	6·9	13	10	—2·7	16·0	7·8	1·8	14·0
Year ...	19·8	13	35	—3·4*c*	36·8*f*	9·0	1·6*g*	20·0*h*

c Jan. 8. *d* July 3. *e* July 2. *f* Aug. 12. *g* Jan 1; July 15 *h* May 18

(To be continued).

THAMES VALLEY RAINFALL. MAY, 1918.



THE WEATHER OF MAY.

MAY opened in a most unseasonable mood. The country was, at the time, under the influence of a cold easterly wind, blowing in the front of a shallow cyclonic system which lay off our south-west coasts; and on the 1st there were few places in which the maximum thermometer touched 50°, and, in the north and east, several places in which it did not reach 45°. On the same night a sharp ground frost occurred in many northern districts, the exposed thermometer falling to 21°, at Blackpool, Aberdeen and Balmoral, and to 23°, at West Linton. Between the 2nd and 6th, the south-western disturbance extended very slowly over nearly the whole kingdom, and the weather became generally unsettled, thunderstorms occurring at some southern stations on the 3rd, and heavy rain in the north-east of Great Britain on the 5th and 6th. The cold easterly wind was, however, soon replaced by more variable breezes, and temperature rose to a fairly seasonable level, the maximum readings on the 4th being in many places quite 15° higher than those of the 1st. With the opening of the second week the conditions, though still changeable, assumed a more normal aspect. For the next few days the weather was influenced by Atlantic depressions which spread in from the westward or north-westward, causing winds from between S. and W., with temperatures differing but little from the average. Between the 9th and 11th, the thermometer rose above 65° in many districts, and touched 71° at Kilmarnock and Waterford.

After the middle of the month anticyclonic conditions were in the ascendant and the weather was, therefore, generally fine. There were, however, two important breaks, one on the 17th, the other on the night of the 22nd or on the 23rd. In each case thunderstorms were very prevalent, those of the latter dates finding their way to almost every corner of Great Britain. In some instances the storms were accompanied by exceedingly heavy falls of rain and hail; on the 17th nearly 3 inches of rain fell at Fulbeck, and on the 23rd nearly 3¼ inches at Beddgelert. Between the 20th and 22nd, temperature rose to an unusually high level for the time of year, readings of 80° and upwards being recorded in nearly all the English districts, and a reading of 84° at Manchester and Clifton (Bristol). Later on the wind, though light, was mainly from some easterly quarter, and the weather was, therefore, much cooler, but at the same time exceedingly fine and bright. In the south-west of England and the south of Ireland the duration of sunshine in the closing week (ended June 1st) amounted to more than 75 per cent., and at Valencia (Cahirciveen) to as much as 88 per cent., of the possible for the season.

The distribution of rainfall during the month was patchy, on account of local thunderstorms. These appear to have been most severe in the south-east Midlands of Englands and particularly in the neighbourhood of Woburn, where very severe flooding and hail occurred on the 17th. The effect of these storms on the rainfall map of the Thames Valley, facing this page, is well marked, and reference is made to their destructive effect in our correspondence pages. Apart from this most of the south of England had less than 2 inches of rain, and the north rather more than 2 inches. Scotland was slightly wetter, but with very moderate falls in the Western Highlands and there, as in Ireland also. the tendency was for the rainfall to be relatively greater in the east than the west. The general rainfall in the countries, expressed as a percentage of the average, was;—England and Wales, 113; Scotland, 94; Ireland, 91; British Isles, 100.

In London (Camden Square), the mean temperature was 57°·7, or 3°·7 above the average of 50 years. The duration of bright sunshine was 185·2 hours, and the duration of rainfall, 28·8 hours. Evaporation, 2·38 in.

RAINFALL TABLE FOR MAY, 1918.

STATION.	COUNTY.	RAINFALL. Aver. 1875–1909. in.	1918. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	1·75	2·11	+ ·36	121	·49	22	11
Tenterden	*Kent*	1·65	1·76	+ ·11	106	·41	5	12
Arundel (Patching)	*Sussex*	1·80	1·83	+ ·03	102	·71	4	9
Fordingbridge (Oaklands)	*Hampshire*	2·09	1·54	— ·55	74	·46	7	9
Oxford (Magdalen College)	*Oxfordshire*	1·81	1·77	— ·04	98	·36	12	9
Wellingborough (Swanspool)	*Northampn*	1·98	2·32	+ ·34	117	·53	3	10
Bury St. Edmunds (Westley)	*Suffolk*	1·93	2·51	+ ·58	130	1·43	23	10
Geldeston [Beccles]	*Norfolk*	1·78	·93	— ·85	52	·42	12	7
Polapit Tamar [Launceston]	*Devon*	2·08	·82	— 1·26	40	·15	25	12
Rousdon [Lyme Regis]	,,	2·02	1·68	— ·34	83	·46	12	11
Stroud (Field Place)	*Gloucester*	2·10	1·72	— ·38	82	·50	17	10
Church Stretton (Wolstaston)	*Shropshire*	2·64	3·54	+ ·90	134	1·38	23	13
Boston	*Lincoln*	1·80	3·59	+1·79	200	1·43	17	9
Worksop (Hodsock Priory)	*Nottingham*	2·08	1·95	— ·13	95	·53	3	9
Mickleover Manor	*Derbyshire*	2·10	2·86	+ ·76	136	·93	23	10
Buxton	,,	3·30	...	...	...	...	...	...
Southport (Hesketh Park)	*Lancashire*	2·13	3·28	+1·15	154	1·07	22	13
Wetherby (Ribston Hall)	*York, W.R.*	2·09	3·92	+1·83	188	·87	21	8
Hull (Pearson Park)	,, *E.R.*	1·98	2·05	+ ·07	103	·45	11	10
Newcastle (Town Moor)	*North'land*	2·04	1·67	— ·37	82	·67	5	11
Borrowdale (Seathwaite)	*Cumberland*	7·50	...	...	...	...	...	...
Cardiff (Ely)	*Glamorgan*	2·56	1·43	—1·13	56	·44	7	14
Haverfordwest	*Pembroke*	2·62	1·62	—1·00	62	·34	12	8
Aberystwyth (Gogerddan)	*Cardigan*	2·63	5·03	+2·40	192	1·68	23	11
Llandudno	*Carnarvon*	1·86	3·70	+1·84	200	·74	23	10
Cargen [Dumfries]	*Kirkcudbrt.*	2·87	2·55	— ·32	89	·40	25	12
Marchmont House	*Berwick*	2·53	2·46	— ·07	97	·74	5	9
Girvan (Pinmore)	*Ayr*	2·98	2·52	— ·46	84	·94	22	17
Glasgow (Queen's Park)	*Renfrew*	2·40	2·15	— ·25	89	·40	5	16
Islay (Eallabus)	*Argyll*	2·58	2·44	— ·14	95	·47	14	16
Mull (Quinish)	,,	2·99	3·49	+ ·50	116	·67	14	20
Balquhidder (Stronvar)	*Perth*	4·10	2·96	—1·14	72	1·48	22	9
Dundee (Eastern Necropolis)	*Forfar*	2·05	3·58	+1·53	175	·85	4	16
Braemar	*Aberdeen*	2·33	2·87	+ ·54	123	·67	22	10
Aberdeen (Cranford)	,,	2·40	1·85	— ·55	77	·73	6	14
Gordon Castle	*Moray*	2·10	1·78	— ·32	85	·45	11	13
Drumnadrochit	*Inverness*	2·33	3·18	+ ·85	136	·94	25	17
Fort William	,,	3·93	3·22	— ·71	82	·66	14	18
Loch Torridon (Bendamph)	*Ross*	4·54	2·85	—1·69	63	·50	9	15
Dunrobin Castle	*Sutherland*	2·19	1·75	— ·44	80	·38	22	11
Glanmire (Lota Lodge)	*Cork*	2·54	2·45	— ·09	96	·82	2	11
Killarney (District Asylum)	*Kerry*	3·05	2·15	— ·90	70	·54	3	15
Waterford (Brook Lodge)	*Waterford*	2·33	2·65	+ ·32	114	·67	3	12
Nenagh (Castle Lough)	*Tipperary*	2·51	2·74	+ ·23	108	·68	3	12
Ennistymon House	*Clare*	2·70	2·06	— ·64	76	·45	6	13
Gorey (Courtown House)	*Wexford*	2·24	2·74	+ ·50	122	·66	23	14
Abbey Leix (Blandsfort)	*Queen's Co.*	2·43	2·60	+ ·17	107	·40	3	14
Dublin (Fitz William Square)	*Dublin*	2·07	2·27	+ ·20	110	·42	3	10
Mullingar (Belvedere)	*Westmeath*	2·51	1·93	— ·58	77	·50	3	11
Crossmolina (Enniscoe)	*Mayo*	3·17	2·58	— ·59	82	·44	3	20
Cong (The Glebe)	,,	2·94	2·18	— ·76	74	·53	14	16
Collooney (Markree Obsy.)	*Sligo*	2·80	2·06	— ·74	74	·39	20	16
Seaforde	*Down*	2·72	2·81	+ ·09	104	1·12	3	14
Ballymena (Harryville)	*Antrim*	2·84	2·17	— ·67	77	·33	3	18
Omagh (Edenfel)	*Tyrone*	2·66	2·52	— ·14	95	·60	22	15

SUPPLEMENTARY RAINFALL, MAY, 1918.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	2·21	XI.	Lligwy	2·94
,,	Ramsgate	1·73	,,	Douglas, Isle of Man	2·87
,,	Hailsham	1·77	XII.	Stoneykirk, Ardwell House...	3·55
,,	Totland Bay, Aston House...	1·33	,,	Carsphairn, Shiel	2·54
,,	Stockbridge, Ashley..	1·66	,,	Langholm, Drove Road	2·90
,,	Grayshott	1·59	XIII.	Selkirk, The Hangingshaw..	2·40
III.	Harrow Weald, Hill House...	1·86	,,	North Berwick Reservoir	2·10
,,	Pitsford, Sedgebrook...	1·78	,,	Edinburgh, Royal Observaty.	2·93
,,	Woburn, Milton Bryant	4·83	XIV.	Biggar	1·86
,,	Chatteris, The Priory	1·73	,,	Maybole, Knockdon Farm ...	2·44
IV.	Elsenham, Gaunts End	2·05	XV.	Buchlyvie, The Manse	2·74
,,	Shoeburyness	1·35	,,	Ardgour House	4·30
,,	Colchester, Hill Ho., Lexden	1·74	,,	Oban	2·99
,,	Ipswich, Rookwood, Copdock	1·66	,,	Campbeltown, Witchburn ..	4·25
,,	Aylsham, Rippon Hall	1·13	,,	Holy Loch, Ardnadam	4·86
,,	Swaffham	2·93	,,	Tiree, Cornaigmore	...
V.	Bishops Cannings	2·02	XVI.	Glenquey	3·30
,,	Weymouth	1·83	,,	Loch Rannoch Wall	3·71
,,	Ashburton, Druid House...	1·26	,,	Blair Atholl	3·84
,,	Cullompton	1·43	,,	Coupar Angus	3·08
,,	Lynmouth, Rock House	1·27	,,	Montrose, Sunnyside Asylum.	3·33
,,	Okehampton, Oaklands	1·49	XVII.	Balmoral	2·11
,,	Hartland Abbey	1·29	,,	Fyvie Castle	1·90
,,	St. Austell, Trevarna	1·11	,,	Keith Station ..	1·75
,,	North Cadbury Rectory	1·87	XVIII.	Rothiemurchus	2·19
VI.	Clifton, Stoke Bishop .	2·08	,,	Loch Quoich, Loan	4·06
,,	Ledbury, Underdown... ...	1·55	,,	Skye, Dunvegan	3·21
,,	Shifnal, Hatton Grange	3·76	,,	Fortrose	2·90
,,	Droitwich	2·31	,,	Glencarron Lodge	2·11
,,	Blockley, Upton Wold	1·86	XIX.	Tongue Manse	1·75
VII.	Grantham, Saltersford	1·42	,,	Melvich	1·43
,,	Market Rasen	...	,,	Loch More, Achfary	1·84
,,	Bawtry, Hesley Hall	2·21	XX.	Dunmanway, The Rectory ..	2·58
,,	Whaley Bridge, Mosley Hall	3·24	,,	Gap of Dunloe Gearahameen	3·40
,,	Derby, Midland Railway	3·25	,,	Mitchelstown Castle	2·24
VIII.	Nantwich, Dorfold Hall	2·41	,,	Darrynane Abbey	...
,,	Bolton, Queen's Park	3·02	,,	Clonmel, Bruce Villa	2·12
,,	Lancaster, Strathspey	2·19	,,	Broadford, Hurdlestown	2·69
IX.	Langsett Moor, Up. Midhope	2·73	XXI.	Enniscorthy, Ballyhyland...	2·81
,,	Scarborough, Scalby	2·51	,,	Rathnew, Clonmannon	2·40
,,	Ingleby Greenhow	2·14	,,	Ballycumber, Moorock Lodge	1·67
,,	Mickleton	1·70	,,	Balbriggan, Ardgillan ..	2·52
X.	Bellingham, High Green Manor	1·48	,,	Castle Forbes Gardens	1·72
,,	Ilderton, Lilburn Cottage ...	2·02	XXII.	Ballynahinch Castle	3·23
,,	Keswick, The Bank	1·82	,,	Woodlawn	2·22
XI.	Llanfrechfa Grange	—	,,	Westport, St. Helens ...	1·79
,,	Treherbert, Tyn-y-waun	2·65	,,	Dugort, Slievemore Hotel ...	1·80
,,	Carmarthen, The Friary	1·70	XXIII.	Enniskillen, Portora	1·99
,,	Fishguard, Goodwick Station.	1·49	,,	Dartrey [Cootehill] ..	2·09
,,	Crickhowell, Tal-y-maes	...	,,	Warrenpoint, Manor House ..	2·95
,,	New Radnor, Ednol	2·77	,,	Belfast, Cave Hill Road	3·08
,,	Birmingham WW., Tyrmynydd	3·73	,,	Glenarm Castle	3·12
,,	Lake Vyrnwy	4·08	,,	Londonderry, Creggan Res...	2·29
,,	Llangynhafal, Plas Drâw	3·58	,,	Milford, The Manse	2·04
,,	Rhwibryfdir	6·11	,,	Killybegs	2·47
,,	Dolgelly, Bryntirion	5·27			

Climatological Table for the British Empire, December, 1917.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	53·8	1	21·6	19	41·1	31·3	32·4	87	82·8	18·9	1·11	14	7·0
Malta	66·2	1	41·2	6	59·1	50·8	...	75	110·0	33·5	2·31	15	2·5
Lagos	89·0	var.	69·0	6	87·9	74·4	74·7	78	147·0	68·3	1·60	6	5·7
Cape Town	94·0	9	53·3	30	78·7	59·0	54·1	60	...	...	·46	3	2·5
Johannesburg	79·5	5	47·2	2	71·4	53·7	54·7	81	...	47·0	7·71	22	7·0
Mauritius	88·9	18	63·7	6	83·8	69·3	61·8	73	...	57·6	1·40	12	5·2
Bloemfontein	88·8	4	50·5	9	84·2	57·6	52·8	55	..	...	2·30	10	4·4
Calcutta...	80·1	10	50·7	24	76·4	55·9	55·0	70	...	43·9	·00	0	1·6
Bombay...	86·3	24	62·7	31	82·8	68·7	65·3	71	137·2	53·9	·00	0	0·5
Madras	86·9	31	63·7	30	82·6	69·0	67·8	78	156·9	59·4	6·06	7	4·9
Colombo, Ceylon ...	86·8	24	64·4	29	84·3	70·9	69·6	80	166·1	55·8	4·30	9	5·3
Hongkong	71·7	1	46·9	31	63·7	55·2	46·6	60	...	...	1·14	3	4·3
Sydney	100·0	23	58·2	11	77·3	63·5	59·8	64	153·0	51·9	1·76	14	5·3
Melbourne	101·0	22	48·7	14	78·1	57·9	52·8	57	153·7	41·4	2·89	6	5·1
Adelaide	104·0	22	47·5	9	85·3	61·5	52·6	44	159·4	39·2	1·02	4	4·1
Perth	95·3	31	51·2	4	77·5	59·3	56·7	66	158·2	44·0	1·96	7	4·5
Coolgardie	105·0	15	52·0	4, 11	86·6	59·8	50·6	42	173·0	45·0	1·02	6	3·2
Hobart, Tasmania ..	87·8	16	42·0	10	70·2	53·5	49·9	64	150·0	35·3	·89	13	6·4
Wellington	76·0	3	45·2	17*b*	67·9	54·4	51·7	71	148·0	34·5	2·86	16	5·8
Jamaica, Kingston ...	87·2	11	63·1	27	83·7	68·0	66·2	79	...	...	1·04	8	2·7
Grenada	86·0	13*a*	70·0	4*c*	88·0	72·0	...	77	138·0	...	7·08	20	5·0
Toronto	41·6	24	—17·0	29	26·7	12·4	13·2	82	78·2	—20·2	2·40	14	...
Fredericton	38·0	9	—25·0	30	21·3	—25·0	5 0	...	...	...	2·15	10	5·6
St. John, N.B. ...	46·5	9	—19·7	30	25·7	8·9	15·8	76	90·0	—20·0	3·04	15	6·2
Victoria, B.C.	56·4	31	27·5	24	45·4	37·3	39·0	90	93·0	22·5	13·02	27	8·8

a—20, 23. *b*—19. *c*—24, 26, 31.

Johannesburg.—Bright sunshine 179·8 hours.

COLOMBO, CEYLON.—Mean temp. 77°·6, or 1°·2 below, dew point 1°·4 below, and R ·01 in. above, averages. Mean hourly velocity of wind 4·6 miles.

HONGKONG.—Mean temp. 59°·2. Bright sunshine 209·0 hours. Mean hourly velocity of wind 11·6 miles.

Melbourne.—Temp. was over 90° for seven consecutive days, an absolute record for early heat in Victoria.

Adelaide.—Mean temp. 2°·3 above, and R ·06 in. above, averages.

Perth.—Rainfall 1·41 in. above average.

Coolgardie.—Temp. 2°·8 below, and R above, averages.

Hobart.—Temp. 1°·5 above, and R 1·10 in. below, averages.

Wellington.—Mean temp. 0°·8 above, and R ·43 in. below, averages. Bright sunshine, 217·4 hours; early part of the month bright and sunny, and latter part cloudy and showery.

Symons's
Meteorological Magazine.

No. 630. JULY, 1918. Vol. LIII.

SIR NAPIER SHAW ON REVOLVING FLUID IN THE ATMOSPHERE.

In a recent memoir communicated to the Royal Society* Sir Napier Shaw gives an extremely interesting and important summary of his views on the subject of "revolving fluid in the atmosphere" following Lord Rayleigh's contribution to the dynamics of this subject based on the paper by Dr. John Aitken, F.R.S. on "The Dynamics of Cyclones and Anticyclones." Lord Rayleigh in the introduction to his paper remarked that "so much of meteorology depends ultimately upon the dynamics of revolving fluid that it is desirable to formulate as clearly as possible such simple conclusions as are within our reach," with the object of finding their application in the phenomena shown by cyclones and anticyclones. At the beginning of the paper Sir Napier Shaw states that in the twenty years during which he has been practically concerned with the progress of dynamical meteorology and the explanation of the observed phenomena of cyclones and anticyclones he has deliberately avoided the discussion of the theory of revolving fluid because he could not find it in the weather maps which form the starting point for such an investigation. In several previous investigations, of which the most exhaustive was the well known memoir dealing with "The Life-History of Surface Air Currents," it was clearly shown that in our latitudes cyclones and anticyclones are not examples of revolving fluid in the special sense referred to, and for that reason cannot be explained on the hypothesis that they are. The situation is summed up by the statement that "if the motion of the air had really been motion of a revolving fluid symmetrical with regard to a vertical axis it would not have appeared in circular form on the map. If it looks circular it is not a case of revolving fluid." This apparent paradox is explained thus, that the rate

* *Royal Soc. Proc.*; A, Vol. 94, pp. 34-52.

at which all the depressions of well marked circular form in our latitudes travel is much the same as that of the wind velocity of which they are composed. Stationary depressions are of irregular form and do not show the characteristic features of strong winds with a definite centre." But when the motion of translation is of the same order of magnitude as the winds the instantaneous motion is round a moving centre, and the actual motion with reference to the centre is the apparent uniform motion round the centre shown on the map combined vectorially with a velocity equal and opposite to that of the translation of the cyclone. Consequently the appearance of uniform and symmetrical instantaneous motion in a cyclone is in itself proof that we have not in that case symmetrical motion, about a centre, of a mass which travels as a whole. In other words the motion of air in cyclones is not the motion of revolving fluid in the special sense referred to." In "The Life History of Surface Air Currents," this conclusion was amply confirmed for all classes and forms of depressions. Cyclonic motion is, therefore, not analogous to that of a vortex ring travelling in air, but on the other hand the trajectories of a moving cyclonic disturbance show that the air flows through the depression. The vortex, therefore, does not actually breathe or pulsate. Visible examples of revolving fluid whose existence cannot be denied are are to be found in the eddy of dry leaves in a gusty wind at a street corner, the "dust-devil" of Eastern deserts, the water spout, the whirlwind, and the tropical cyclone, which is universally treated in text books of meteorology as a gigantic eddy typically analagous to the vortex ring. These, Sir Napier Shaw says, *may* (the italics are ours) be cases of revolving fluid, but they do not correspond with the phenomena of the cyclonic depressions of middle latitudes such as those experienced in the British Isles, where, during the ten years ending with 1916, a new cyclonic depression was shown on the weather maps on the average every third day. It is pointed out that a cyclonic disturbance which began as revolving fluid in the tropics is gradually transposed in higher latitudes into an ordinary cyclonic depression "and yet we have to deny the identity of the two types of phenomenon." Here a short digression containing a mathematical proof is given to show how the revolving tropical cyclone passes into the depression of our own latitudes, and how it is quite possible that in the end "the conditions necessary for maintaining a core of revolving fluid disappear and the whole system degenerates (if that is the correct expression) into cyclonic motion without a core of revolving fluid." There is nothing in the weather maps to contradict such a suggestion, although it is pointed out that owing to the destruction of buildings, instruments and sometimes the human beings who attend to them, the tropical revolving storm is a very unsatisfactory example of revolving fluid for scientific purposes. It is thus impossible to ascertain whether the behaviour

of a tropical storm is in harmony with Lord Rayleigh's theory or Dr. Aitken's practical illustrations. Sir Napier Shaw in his investigations starts with the assumption which meteorologists cannot deny that temporary whirls are actually visible, and cites a case described by Mr. R. H. Curtis of a whirl which carried off the sheets of music from an open-air band-stand with a spinning motion to a great height and dropped them some miles away. Here there are obviously two elements, the current which carries the whirl, and the whirl within the current. The supposition is made that we have here a mass of revolving fluid with a discontinuity of velocity at the circle bounding the revolving mass. There may be a relation at the margin of the whirl and the wind in the current which carries it, but as shown by Lord Rayleigh, and Dr. Aitken, the velocity in the whirl at any time depends upon dynamical or physical processes within the whirling mass itself. No general assumption can therefore be made of a relation between the velocity in the whirl and the rate of its translation. The difficulty of investigating small whirls is that they cannot be detected on the working weather map, if under twenty miles in diameter. The vortex that appears on such a map it is shown "must be more like a penny than a pin." A method was devised for the investigation and identification of vortices having a temporary existence in the atmosphere, but not to be found directly on the map. This is described on pp. 40-44 of Sir Napier Shaw's paper, but considerations of space render it impossible to go into the matter here with the fulness necessary for a clear understanding of the procedure. It will be sufficient to say that in addition to a large number of illustrative cases two special cases are cited, *viz.*, tho destructive "secondary" depression of March 24th, 1895, which in the eastern counties of England was unattended with any rainfall either before, or during, or after the strong wind. Except for the wind it was a fine afternoon and remained so. The second case is the tornado in Devonshire and South Wales on October 27th, 1913, which did not appear on the working charts at 6 p.m. when the greatest damage was done. The first case may "be cited as a good example of revolving fluid carried along in a main current, the velocity of translation being governed by the spacing of the isobars of the main depression outside the area affected by the local rotation, and, in virtue of this, the air which formed the mass of revolving fluid over the south of Ireland at 8 a.m., was carried along bodily to Denmark by 6 p.m." As a good deal of rain fell in the west its existence is *prima facie* evidence of considerable convection in the atmosphere. It is thus reasonable to suppose that the special conditions involved in the maintenance of a column of revolving fluid are satisfied, namely that the wind velocity in the surrounding medium should be the same at all elevations. The second case cited, *viz.*, the tornado in the Taff Valley, Glamorgan, in which the barograph near the centre showed

a sudden fall and recovery of 10 mb. (·30 in.), within less than one minute, and where the localities where damage was done were those of heavy rainfall, was evidently associated with a very definite line of discontinuity marking off the area of rotational velocity from its environment. The destruction in South Wales seems to have been occasioned by the conveyance of the air within the moving column of revolving fluid, forming an excellent example of the progression of revolving fluid, although it was impossible to identify it on a map. Sir Napier Shaw sums up his conclusions in the following words, "We are thus able to draw a definite distinction between the cyclonic or anticyclonic motion as exhibited in the atmosphere and cases of revolving fluid motion. In the latter there is rotation about the vertical axis and the whole mass of revolving fluid is carried along bodily in a current of air which has a velocity corresponding with its position in the main cyclonic system and which can be related to the run and the distance apart of the isobars. There is practical discontinuity of velocity between this current and the rotating mass, and there is no relation between the velocity of wind in the whirl and the velocity of translation in which the whirl travels over the country. In the case of a cyclonic depression the travel over the country is a part of the motion of the wind in the cyclone itself. There is no discontinuity of velocity. The wind so moves that each part of it revolves about a centre which has a motion of translation. The rate of progress of the centre depends upon the curvature of the path of the air in the cyclone, and the motion of the centre is apparently due to the fact that the cyclostrophic component of the pressure is governed by the radius of curvature of the path and not by the radius of the circle of instantaneous motion. The motion in a travelling cyclonic depression is therefore of a different type from that of motion in a circle with a superposed velocity of translation." The memoir concludes with a supplementary note remarking that the terms used by the author are remarkably similar to those employed by Prof. R. de C Ward in his investigation on "Tornadoes in the United States," published last July in the *Quar. Jour. Roy. Met. Soc.* There can be little doubt that these violent manifestations are columns of revolving fluid developed locally in the southern portions of large cyclones and carried along with the ordinary wind of the cyclone in which they are formed. R. C. M.

ROYAL METEOROLOGICAL SOCIETY.

THE last monthly meeting for the 1917-18 Session was held on June 19th, at 70, Victoria Street, S.W., Sir Napier Shaw, F.R.S., President, in the Chair.

Dr. S. Chapman, F.R.A.S., read a paper entitled "The Lunar Atmospheric Tide at Greenwich, 1854-1917." The tidal forces, due to the moon, affect the aerial as well as the fluid ocean, and the lunar atmospheric tide is manifested by a periodic variation in the height of the barometer having two maxima and two minima (high and low tide) in the course of a lunar day. This variation is much smaller than the solar semi-diurnal barometric variation, which is not a simple solar tidal effect; the minute lunar variation, however, can be detected with ease in the records of tropical observatories, where the irregular fluctuations of pressure are small. Attempts to determine it in the records of European observatories have been made, but hitherto without success. By treating hourly observations of "quiet" days only, on which the barometric range did not exceed 0·1 in., and by abstracting the solar variation, the lunar atmospheric tide at Greenwich has now been ascertained. Its total amplitude is less than 0·001 in., the harmonic formula being $0{\cdot}00038 \sin (2t + 114°)$ inch, where "t" represents lunar time measured, at the rate of 360° per lunar day, from the epoch of upper transit. A comparison with the variation at Batavia (lat. 6° S.), viz., $0{\cdot}00256 \sin (2t + 65°)$ inch, suggests that the amplitude varies as the fourth power of the cosine of latitude, and that the phase also varies with latitude.

A paper by Mr. Miller Christy was also read, entitled, "The Audibility of Gunfire on the Continent at Chignal St. James, near Chelmsford, during 1917," in which the author continued his series of observations of the sound of gunfire commenced in 1915 and published by the Society in 1916. In the present paper the record is confined entirely to Mr. Christy's observations at Chignal St. James. The most interesting point in connection with the observations is that there is apparently (1) a regular and well-defined season or period during which the gunfire is usually audible with ease, and that this is followed by (2) a longer season or period during which the gunfire is seldom or never heard. The following are the earliest and latest dates of the sound of the gunfire on the Continent as heard at Chignal St. James during the three years 1915-1917 :—

1915—From about	**1st May**	**to about**	**31st August**	**=**	**17**	**weeks**	**3**	**days**
1916—	**„**	**„**	**1st May**	**„**	**15th August**	**=**	**15**	**„**	**1**	**„**
1917—	**„**	**„**	**22nd April**	**„**	**6th Sept.**	**=**	**19**	**„**	**4**	**„**

Mr. F. J. W. Whipple, F.R.Met.Soc., contributed a paper entitled, "Seasonal Variation in the Audibility of Gunfire." Mr. Christy's

observations indicate that in Essex continental gunfire is only heard during the summer months. On the other hand, evidence collected by W. Brand and published in the *Meteorologische Zeitschrift*, in February, 1917, indicates that in Germany at places 100 km. or more from the firing line, such sounds are only heard during the winter. Thus it appears that in summer the outer zone of audibility lies to the west of the source of sound, in winter to the east. No theory hitherto put forward in explanation of the existence of the outer zone of audibility is in accord with this generalization.

The following gentlemen were elected Fellows of the Society :—Messrs. F. G. Bales, J. Hooley, H. E. Richards, F. L. Watkins, Rev. T. E. R. Phillips, Lieut. W. H. Pick, R.E. and Ensigns P. J. Barnes, J. C. Boyd, A. Gardner, H. le G. Goodspeed and W. S. Vanderbilt, of the U.S. Naval Reserve Force.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

DRY AIR AT TOTLAND BAY.

The mean humidity for the month of June at 9 a.m. (Greenwich time) amounted to only 69·4 per cent. This is the driest June atmosphere during all the thirty-two Junes I have taken readings at Totland Bay. The nearest approach to it was in June, 1911, with a relative humidity of 71·3 per cent. The boundary line of Totland parish measures eight miles; six of these miles are washed by the sea.

An absolute drought of 17 days ended on June 8th, showing a deficiency of 97 tons of rain water to the acre, and a partial drought of 33 days terminated on June 14th, giving a deficiency of 157 tons of water to the acre.

On June 15th, we had the unusual scene for half an hour of fields all white with large hailstones in the late afternoon; distant thunder, but no lightning accompanied the hail.

Many places have had ground frosts this June, but the nearest approach to it here was a temperature of 35·9 F. by the exposed thermometer on the grass on June 26th. JOHN DOVER.

Aston House, Totland Bay, Isle of Wight.

BLACK RAIN.

In case it is of any interest I am reporting to you that in a very heavy rainfall, on Monday afternoon, June 17th, here (about 6 p.m. summer-time) the rain was black as if full of soot, not only close to buildings but in the rain gauge. I was not at home at the time, but my daughter kept the contents. I understand the wind was northerly. Could the storm have brought London smoke in suspension? We are about twenty-nine miles from the City, but it is the only solution I can think of. T. H. W. BUCKLEY.

The Grange, Crawley Down, June 19th, 1918.

WARM MAYS.

During recent years there has been a remarkable predominance of warm Mays According to the Meteorological Office Calendar, the mean temperature for May in the Midlands, as derived from observations made in the period 1881-1905, is 51°·1, F.

This value has been exceeded here in nine out of the past eleven years. The mean temperature of May for the decade 1908-17 was 52°·9, and, according to the law of averages, a cold May was certainly due in 1918. Yet the May just passed was warmer than any in the preceding ten years. The mean temperature was as high as 55°·9, with "summer heat" on six days, and a maximum reading of 84°—the highest temperature recorded here in May during the past quarter century. DAVID HILL OWEN.

Sparkhill, Birmingham, June 7th, 1918.

DIURNAL VARIATION OF PRESSURE AND WIND VELOCITY.

It is well known that at exposed places like the top of Ben Nevis, and probably also at other stormy spots on our western coasts, the barometric pressure is reduced appreciably with winds above a certain force. This effect increases with each augmentation in wind velocity and is due to the suck-out of air from the room in which the barometer is hung. As wind velocity has a well-marked diurnal range, the hourly values of pressure must be modified accordingly, especially at places where the wind velocity is high, and its daily range considerable. Has this factor ever been taken into account in discussing the diurnal range of pressure in exposed situations?

R. C. MOSSMAN.

Edinburgh, June 4th, 1918.

LOCAL WHIRLWIND.

My gardener has told me of a curious little whirlwind he witnessed some days ago. Two men were digging a piece of ground in the middle of the orchard where the apple trees are far apart, sloping towards south-east, they heard a noise like distant thunder; as it continued they looked up and saw dead leaves being swept up from the ground and whirled to a height of 40 feet. This whirlwind moved in an irregular direction, and when it passed near them seemed to be icy cold. I believe it was a sunny afternoon, with north-east wind.

R. B. ROGERS.

Hexworthy, Launceston, Cornwall, April 26th, 1918.

GOVERNMENT COMMITTEE ON WATER POWER.

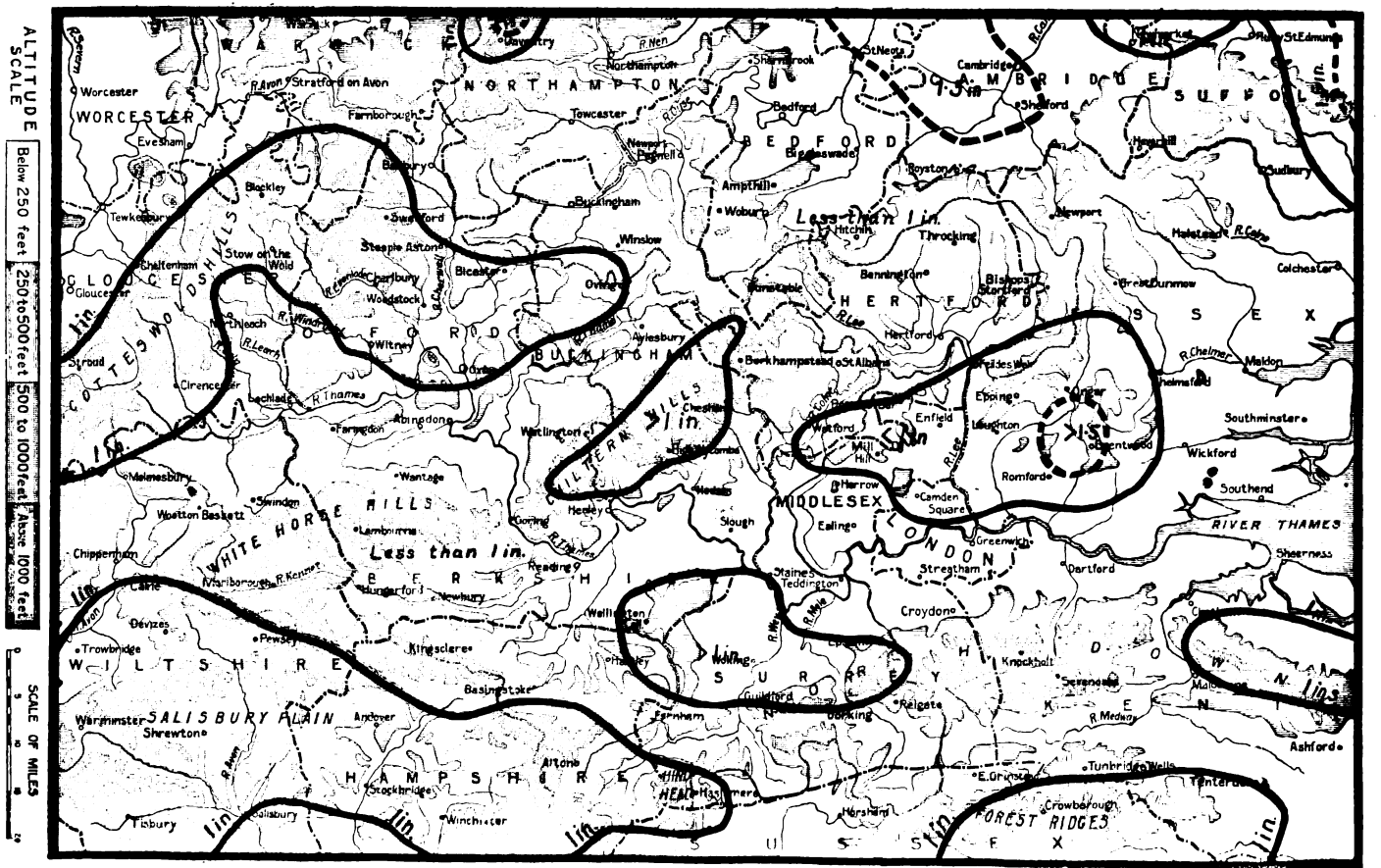
The Board of Trade, with the concurrence of the Ministry of Reconstruction, have appointed a Committee to examine and report upon the Water Power resources of the United Kingdom, and the extent to which they can be made available for industrial purposes. The following are the members of this Committee:—Sir John F. C. Snell, C.E., Chairman; Mr. G. S. Albright, Mr. H. F. Carlill (Board of Trade), Sir Dugald Clerk, F.R.S., Dr. J. F. Crowley, Mr. Philip Dawson, Professor Gibson of University College, Dundee, Mr. Vernon Hartshorn, Dr. H. R. Mill, Mr. A. Newlands, C.E., Mr. G. C. Vyle (Associated Chambers of Commerce), Mr. A. J. Walter, K.C., Mr. Ralph Walter (Ministry of Reconstruction) and Mr. D. J. Williams. Mr. R. T. G. French is the Secretary of the Committee, the address of which is 10, Princes Street, Westminster, London, S.W. 1.

The Sub-Committee of the Conjoint Board of Scientific Societies for enquiring into the Water Power of the British Empire, under the chairmanship of Sir Dugald Clerk, has, as the result of its investigations drawn up a preliminary report for presentation to the Conjoint Board.

NEW POSTAL RATES.

Rainfall observers who send in monthly postcards (British Rainfall, Form C.) can continue to do so at the ½d. rate of postage, provided that when completed in hand-writing the latter refers solely to the subject matter. This would exclude any remark other than one relating to the weather of the month. Until a new edition of cards can be printed, the words "Post Card" should be struck out and the words "Printed Paper" substituted.

THAMES VALLEY RAINFALL JUNE, 1918



THE WEATHER OF JUNE.

A SPELL of fine warm weather, which had commenced about the third week in May, continued throughout the early days of June. On the 2nd. which proved by far the hottest day of the month, the thermometer rose slightly above 80° in many parts of England and Ireland, and reached 83° at Camden Square and 84° at Killarney. In the eastern, central and south-eastern districts the nights were, however, cold, and between the 3rd and 5th, a sharp ground frost occurred in many places, the exposed thermometer falling to 19° at Raunds (Northants), 26° at Greenwich, and 27° at Wisley.

Towards the close of the first week an absolute drought (which had, however, only just exceeded the prescribed limits) came to an end, and for more than a fortnight the weather was generally cool and showery. The wind was usually from some point between W. and N., and on the 9th and 10th, when small depressions moved south-eastwards across the country, a gale was experienced in many of the western and northern districts, the velocity of the wind in gusts being as high as 76 miles per hour at Aberdeen. Between the 12th and 15th, a large cyclonic disturbance passed slowly eastwards from Iceland to Scandinavia, while further secondaries moved directly across the United Kingdom. Thunderstorms were experienced in many isolated parts of Great Britain on the 15th, and in the south-east of England on the 16th and 17th, while on the 18th and 19th, when a well marked depression moved eastwards across our southern districts, a heavy fall of rain occurred in some parts of Devonshire and South Wales. The day temperatures recorded about this time were extremely low for the time of year, the thermometer in many places failing to reach 55°, and the nights were also very cold. One of the most striking features in the weather of June was in fact the general prevalence of ground frosts. In addition to the cases already quoted (between the 3rd and 5th) the phenomenon was observed on the nights of the 14th the 16th-17th, and between the 23rd and 25th. At Benson (Oxon.) ground frost occurred during the month on as many as eight nights, three of which were consecutive. Strong N.W. winds, which prevailed on the 22nd, again reached gale force in many places, the gusts blowing with a velocity of 60 miles an hour, at Southport, and 54 miles at Paisley, Eskdalemuir and Holyhead. In the closing week the weather became more settled, and although the nights remained cold, the day temperatures gradually rose to a point slightly in excess of the June average.

The total amount of bright sunshine for the month was in excess of the normal. In most districts the departure was slight, but in England S.W. the mean daily duration was an hour and a half more than the average.

The rainfall was practically everywhere below the average, most so in England, where only a few districts had as much as 50 per cent. In the east of Scotland also less than half the average fell. The total fall was less than an inch in the east generally and very few stations in England had as much as 2 inches. In Wales and the west of Scotland considerable areas had more than three inches, but this amount was experienced only very locally in the west of Ireland.

In London (Camden Square), the mean temperature was 59°·3, or 0·8 below the average. The duration of bright sunshine was 188·2 hours, and of rainfall, 18·6 hours. The total evaporation from a free water surface was 3·01 in.

RAINFALL TABLE FOR JUNE, 1918.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875–1909. in.	1918. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·28	1·30	— ·98	57	·42	14	11
Tenterden	*Kent*	2·03	·96	—1·07	47	·31	19	11
Arundel (Patching)	*Sussex*	2·13	·85	—1·28	40	·40	18	8
Fordingbridge (Oaklands)	*Hampshire*	1·93	·96	— ·97	50	·54	18	7
Oxford (Magdalen College)	*Oxfordshire*	2·27	1·07	—1·20	47	·32	18	13
Wellingborough (Swanspool)	*Northampn*	2·14	·49	—1·65	23	·09	18	14
Bury St. Edmunds (Westley)	*Suffolk*	2·21	·95	—1·26	43	·33	19	10
Geldeston [Beccles]	*Norfolk*	1·77	1·90	+ ·13	108	·88	17	12
Polapit Tamar [Launceston]	*Devon*	2·18	1·93	— ·25	88	·62	18	12
Rousdon [Lyme Regis]	,,	2·18	1·02	—1·16	47	·64	18	8
Stroud (Field Place)	*Gloucester*	2·43	·96	—1·47	40	·45	18	11
Church Stretton (Wolstaston)	*Shropshire*	2·59	1·03	—1·56	40	·26	18	9
Boston	*Lincoln*	1·95	·81	—1·14	42	·35	25	10
Worksop (Hodsock Priory)	*Nottingham*	2·06	·80	—1·26	39	·29	25	9
Mickleover Manor	*Derbyshire*	2·55	·81	—1·74	32	·18	9	11
Congleton (Buglawton Vic.)	*Cheshire*	2·69	1·93	— ·76	72	·39	9	17
Southport (Hesketh Park)	*Lancashire*	2·26	1·66	— ·60	73	·50	6	12
Wetherby (Ribston Hall)	*York, W.R.*	2·17	·72	—1·45	33	·35	16	4
Hull (Pearson Park)	,, *E.R.*	2·09	·40	—1·69	19	·11	6	9
Newcastle (Town Moor)	*North'land*	2·04	·71	—1·33	35	·30	6	7
Borrowdale (Seathwaite)	*Cumberland*	6·94	...	...	...	...	...	...
Cardiff (Ely)	*Glamorgan*	2·55	1·87	— ·68	73	1·01	18	14
Haverfordwest	*Pembroke*	2·74	1·63	—1·11	59	·59	18	9
Aberystwyth (Gogerddan)	*Cardigan*	2·97	2·18	— ·79	73	·67	9	12
Llandudno	*Carnarvon*	1·97	1·26	— ·71	64	·41	9	12
Cargen [Dumfries]	*Kirkcudbrt.*	2·84	1·42	—1·42	50	·33	6	14
Marchmont House	*Berwick*	2·38	·47	—1·91	20	·16	15,30	7
Girvan (Pinmore)	*Ayr*	3·04	2·19	— ·85	72	·44	9	15
Glasgow (Queen's Park)	*Renfrew*	2·41	1·11	—1·30	46	·21	7·22	12
Islay (Eallabus)	*Argyll*	2·80	2·14	— ·66	77	·33	15	21
Mull (Quinish)	,,	3·30	2·96	— ·34	90	·57	6	19
Balquhidder (Stronvar)	*Perth*	4·07	...	...	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	2·06	·81	—1·25	39	·33	15	10
Braemar	*Aberdeen*	2·18	·91	—1·27	42	·16	15	11
Aberdeen (Cranford)	,,	2·02	1·57	— ·45	77	·28	20	15
Gordon Castle	*Moray*	2·13	1·89	— ·24	89	·47	15	15
Drumnadrochit	*Inverness*	2·26	2·14	— ·12	95	·50	15	18
Fort William	,,	3·77	3·83	+ ·06	102	1·21	13	16
Loch Torridon (Bendamph)	*Ross*	4·07	4·10	+ ·03	100	·73	6	17
Dunrobin Castle	*Sutherland*	2·10	1·46	— ·64	70	·52	22	10
Glanmire (Lota Lodge)	*Cork*	2·91	·97	—1·94	34	·43	8	9
Killarney (District Asylum)	*Kerry*	2·92	2·54	— ·38	87	·52	8	13
Waterford (Brook Lodge)	*Waterford*	2·79	1·80	— ·99	65	·39	8	10
Nenagh (Castle Lough)	*Tipperary*	2·70	1·69	—1·01	63	·46	8	15
Ennistymon House	*Clare*	3·18	1·77	—1·41	56	·33	8	14
Gorey (Courtown House)	*Wexford*	2·59	1·29	—1·30	50	·29	8	11
Abbey Leix (Blandsfort)	*Queen's Co.*	2·58	1·70	— ·88	66	·43	8	16
Dublin (Fitz William Square)	*Dublin*	2·00	·91	—1·09	45	·19	9	13
Mullingar (Belvedere)	*Westmeath*	2·72	1·89	— ·83	69	·38	9	11
Crossmolina (Enniscoe)	*Mayo*	3·17	1·74	—1·43	55	·29	17	14
Cong (The Glebe)	,,	3·18	1·38	—1·80	43	·33	16	13
Collooney (Markree Obsy.)	*Sligo*	3·11	2·79	— ·32	90	·76	8	18
Seaforde	*Down*	2·88	1·43	—1·45	50	·36	18	12
Ballymena (Harryville)	*Antrim*	2·89	2·14	— ·75	74	·37	9	17
Omagh (Edenfel)	*Tyrone*	2·82	1·92	— ·90	68	·60	9	15

SUPPLEMENTARY RAINFALL, JUNE, 1918.

Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	·91
,,	Ramsgate.....	·87
,,	Hailsham.....	·99
,,	Totland Bay, Aston House...	1·02
,,	Stockbridge, Ashley..	·99
,,	Grayshott.....	1·14
III.	Harrow Weald, Hill House...	·97
,,	Pitsford, Sedgebrook.....	·48
,,	Woburn, Milton Bryant.....	·46
,,	Chatteris, The Priory..... ...	·25
IV.	Elsenham, Gaunts End	·79
,,	Shoeburyness	·67
,,	Colchester, Hill Ho., Lexden	·58
,,	Ipswich, Rookwood, Copdock	1·54
,,	Aylsham, Rippon Hall..... ..	1·43
,,	Swaffham	·55
V.	Bishops Cannings	1·47
,,	Weymouth.....	·62
,,	Ashburton, Druid House.. ...	1·70
,,	Cullompton	1·11
,,	Lynmouth, Rock House	1·49
,,	Okehampton, Oaklands.....	1·47
,,	Hartland Abbey.....	1·53
,,	St. Austell, Trevarna	1·46
,,	North Cadbury Rectory.....	·84
VI.	Clifton, Stoke Bishop	1·21
,,	Ledbury, Underdown..... ...	·71
,,	Shifnal, Hatton Grange.....	1·02
,,	Droitwich.....	·72
,,	Blockley, Upton Wold.....	1·27
VII.	Grantham, Saltersford.....	·16
,,	Louth Westgate	·51
,,	Bawtry, Hesley Hall	·88
,,	Whaley Bridge, Mosley Hall	2·50
,,	Derby, Midland Railway.....	·56
VIII.	Nantwich, Dorfold Hall	1·16
,,	Bolton, Queen's Park	2·39
,,	Lancaster, Strathspey	2·08
IX.	Langsett Moor, Up. Midhope	1·23
,,	Scarborough, Scalby	·59
,,	Ingleby Greenhow	·82
,,	Mickleton	·60
X.	Bellingham, High Green Manor	·65
,,	Ilderton, Lilburn Cottage ...	·44
,,	Keswick, The Bank.....	1·85
XI.	Llanfrechfa Grange	...
,,	Treherbert, Tyn-y-waun	4·09
,,	Carmarthen, The Friary	1·32
,,	Fishguard, Goodwick Station.	1·15
,,	Crickhowell, Tal-y-maes.....	1·50
,,	Gwernarglwydd	4·50
,,	Birmingham WW., Tyrmynydd	2·55
,,	Lake Vyrnwy	...
,,	Llangynhafal, Plas Draw.....	1·72
,,	Rhwibryfdir	4·88
,,	Dolgelly, Bryntirion.....	4·49
XI.	Lligwy	1·62
,,	Douglas, Isle of Man	1·90
XII.	Stoneykirk, Ardwell House...	1·95
,,	Carsphairn, Shiel.....	2·85
,,	Langholm, Drove Road	1·08
XIII.	Selkirk, The Hangingshaw..	·44
,,	North Berwick Reservoir.....	·14
,,	Edinburgh, Royal Observaty.	·42
XIV.	Biggar.....	·95
,,	Maybole, Knockdon Farm ...	1·41
XV.	Buchlyvie, The Manse.....	1·58
,,	Ardgour House	6·63
,,	Oban.....	2·59
,,	Campbeltown, Witchburn ..	...
,,	Holy Loch, Ardnadam.....	2·49
,,	Tiree, Cornaigmore	...
XVI.	Glenquey	1·70
,,	Loch Rannoch Dall.....	1·87
,,	Blair Atholl	·64
,,	Coupar Angus	·82
,,	Montrose, Sunnyside Asylum.	1·51
XVII.	Balmoral	1·02
,,	Fyvie Castle	...
,,	Keith Station	2·93
XVIII.	Rothiemurchus	·91
,,	Loch Quoich, Loan	12·20
,,	Skye, Dunvegan	4·16
,,	Fortrose.....	1·83
,,	Glencarron Lodge	5·29
XIX.	Tongue Manse	3·00
,,	Melvich	2·95
,,	Loch More, Achfary	6·35
XX.	Dunmanway, The Rectory ..	1·58
,,	Mitchelstown Castle.....	1·12
,,	Gap of Dunloe Gearahameen	4·20
,,	Darrynane Abbey.....	1·85
,,	Clonmel, Bruce Villa	1·31
,,	Broadford, Hurdlestown.....	1·83
XXI.	Enniscorthy, Ballyhyland...	1·63
,,	Rathnew, Clonmannon	1·09
,,	Ballycumber, Moorock Lodge	2·31
,,	Balbriggan, Ardgillan	1·47
,,	Castle Forbes Gardens.....	1·69
XXII.	Ballynahinch Castle.....	2·60
,,	Woodlawn	1·16
,,	Westport, St. Helens	1·73
,,	Dugort, Slievemore Hotel ...	2·14
XXIII.	Enniskillen, Portora.....	2·09
,,	Dartrey [Cootehill]	2·61
,,	Warrenpoint, Manor House ..	1·85
,,	Belfast, Cave Hill Road	1·66
,,	Glenarm Castle	2·30
,,	Londonderry, Creggan Res...	3·84
,,	Milford, The Manse.....	2·61
,,	Killybegs	3·49

Climatological Table for the British Empire, January, 1918.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	54·9	21	16·1	9	44·6	34·2	36·2	88	87·6	16·5	2·86	18	8·2
Malta	64·6	25	40·5	7	59·0	50·9	...	80	117·0	31·6	·44	4	2·3
Lagos	90·2	30*a*	67·2	17	87·7	72·3	69·0	69	145·0	61·0	·00	0	6·5
Cape Town	97·0	27	53·1	26	81·6	60·1	55·0	58	...	...	·05	1	1·8
Johannesburg	84·3	27	42·0	25	72·2	53·0	54·3	83	...	41·5	4·96	18	7·2
Bloemfontein	90·2	28	48·3	5	80·7	57·5	55·2	63	...	...	4·67	11	4·1
Calcutta...	77·8	24	47·8	6	75·6	53·2	50·4	62	..	37·1	·00	0	2·0
Bombay...	86·8	30	62·8	25	83·3	68·2	63·3	67	136·0	54·1	·00	0	1·5
Madras	88·0	26	64·9	6	81·8	69·9	68·5	81	152·6	63·3	8·05	10	5·2
Colombo, Ceylon ...	88·1	28	66·9	19	84·2	70·7	69·0	80	159·0	59·0	4·25	10	6·2
Hongkong	66·7	12	42·1	9	59·2	49·8	33·8	46	...	...	·01	2	3·0
Sydney	81·2	27	59·2	3	76·0	64·7	61·5	70	153·2	55·4	13·18	19	5·8
Melbourne	98·7	25	52·7	2	79·9	60·7	56·7	63	151·0	44·0	2·44	9	4·4
Adelaide	104·6	21	51·7	1, 17	87·9	64·2	55·0	45	161·0	43·8	·38	3	2·3
Perth	107·0	9	52·8	3	89·1	66·7	59·3	55	171·6	47·3	·43	4	2·9
Coolgardie	108·6	25	51·0	14	92·0	63·2	50·5	36	174·2	48·0	·01	1	2·4
Brisbane	94·1	14	61·8	6	82·9	67·0	64·8	73	156·7	55·9	7·70	21	7·2
Hobart, Tasmania ..	95·1	21	46·0	17	70·2	54·2	50·6	65	148·8	39·2	·99	10	6·3
Wellington	78·5	17	46·7	30	70·2	58·0	55·2	73	154·0	34·4	1·73	11	5·9
Jamaica, Kingston ...	91·5	26	56·9	2	84·5	67·1	64·4	74	...	...	·58	3	2·8
Grenada	87·0	3	69·0	16	82·0	71·0	...	77	138·0	...	6·16	21	4·0
Toronto	33·1	7	—8·0	27	20·4	6·0	6·6	81	95·5	—10·5	2·30	13	5·6
Fredericton	36·0	7	—28·0	3	18·8	—1·4	4·0	86	...	...	3·11	12	5·0
St. John, N.B. ...	38·0	13	—13·5	3	22·1	6·4	7·3	73	103·5	—13·7	3·71	17	5·4
Victoria, B.C.	56·0	3	23·2	30	45·8	38·3	38·0	86	105·0	16·6	...	...	...

a—31.

Johannesburg.—Bright sunshine 189·9 hours.

COLOMBO, CEYLON.—Mean temp. 77°·5, or 1°·2 below, dew point 0°·4 below, and R 1·06 in. above, averages. Mean hourly velocity of wind 5·0 miles.

HONGKONG.—Mean temp. 54°·0. Bright sunshine 241·9 hours. Mean hourly velocity of wind 10·8 miles.

Sydney.—Very heavy R on the 11th when 6·53 in. fell in 24 hours.

Melbourne.—Mean temp. 2°·9 above, and R ·58 in. above, averages.

Adelaide.—Mean temp. 1°·9 above, and R ·34 in. below, averages.

Perth.—The hottest January since 1896, the temperature on 17 days being over 90°.

Coolgardie.—Rainfall about half an inch below average.

Brisbane.—Mean temp. 2°·7 below average. Rainfall slightly above average.

Wellington.—Bright sunshine, 206·4 hours. Mean temp. 1°·7 above average.

Symons's Meteorological Magazine.

No. 631. AUGUST, 1918. Vol. LIII.

THE THUNDERSTORMS OF JULY 16th TO 20th, 1918.

Thunderstorms of exceptional severity occurred in the south-eastern and Midland districts of England during this period and we print a few of the accounts which have been sent to us, adding some supplementary notes.

The principal storms appear to have been three in number. (1) The first, in east Surrey, occurred in the early hours of July 16th, and was remarkable for extraordinary hail, which is described by several correspondents. (2) On the evening of the 17th, London, especially the south, experienced exceptionally heavy rain, and a local storm of great severity is reported from Hawkedon, near Bury St. Edmunds, and one of less severity in Sussex. A sharp storm also occurred at at Edinburgh later on the same evening. (3) The storm of July 20th appears to have been most notable in the Midlands, particularly round Worksop and Todmordon. The following correspondence deals with details of these storms.

JULY 16th.

About 2.15 a.m. on the 16th violent thunder and lightning began with heavy rain evidently accompanied by hail. In a minute violent blows were struck on the south windows by huge hailstones and less than a minute later they fell at such a rate that the deafening sound prevented the thunder from being audible. This continued for about six minutes, without the slightest slackening. When the hailstones struck the windows there was a phosphorescent flash. The lightning showed that the hillsides were white as with snow. In about 9 or 10 minutes from the start the hail had entirely ceased, and in another minute rain also practically ceased. The entire roof of the greenhouse was smashed and round the house hail lay 2 or 3 inches deep, being scattered unevenly about an inch deep on the level. Damage to vegetation was very great. The storm passed off to east by south, having come from west by south, but

the wind was south by west. The total rainfall for the day was 1·03 in., of which ·80 in. almost certainly fell in ten minutes.

The hail was of three forms still quite distinct at 6 a.m. The largest had an opaque core about ¼ in. in diameter, and were spherical or "bun-shaped" with jagged protruberances, some nearly an inch long. These were not smaller stones frozen on. Another form was opaque, very hard, and oval to spherical, from ½ to ¾ in. across and looking like big sugar plums. Mixed with these were ordinary opaque hailstones. The rain was quite warm and the fall of temperature during the storm was only from 62·°5 to 59°·5 F.

The track of the storm across the valley was apparently only 300 yards wide in the worst parts, and lay nearly from south-west to north-east, and the greatest damage was almost within a mile east or west, through Walton, Tadworth, Chipstead, Coulsdon and Purley, mainly east of the Brighton Road, and Lower Sanderstead, Ballards on Shirley Hills, to Lower Shirley on the Wickham Road. The final traces of hail were at Bromley. Many windows were broken in Godstone and Little Roke, Kenley, but Kenley proper escaped almost entirely. J. EDMUND CLARK

Asgarth, Purley, July 16th, 1918.

After a thunder and hail storm at Purley, Surrey, this morning, between 3 and 3.30 a.m., I went into the garden and picked up large jagged hailstones. Some were of enormous size and one —a fairly regular oval or lemon shape—was 4½ inches in circumference. They were not several stones stuck together after fall to the ground, but were lying quite distinct on the lawn with appreciable spaces of grass between, and each was complete in itself. They were picked up almost immediately after the fall.

The above measurement was made by myself with a tape measure in the presence of my wife and two other persons. Its accuracy is supported by the fact that as late as 7 a.m. this morning, I found many distinct and separate stones of an inch or more in diameter still lying in sheltered spots. The hail broke windows in the house and completely smashed in the glass roof of a conservatory. Roads were badly torn up and flooded. E. C. RUTHERFORD.

L. B. and S. C. Railway, London Bridge Terminus, S.E., July 16th, 1918.

An extraordinarily violent hailstorm passed over here this morning at 3.30 a.m. (summer time). I was awoken by distant thunder and lightning about 2.30 and the storm appeared to approach from the direction of Kenley. When the hail fell the stones were apparently large from the first, and by the aid of the lightning I saw large masses of hailstones slide off the roof and crash to the

ground. They came down every chimney, and, coated with soot, rolled about the floors in size from that of a pea up to conglomerations of 1½ inch either way and ¾ inch thick. Probably larger stones fell. The lawns remained white for half an hour after the fall although a warm, heavy rain continued to fall. Eight hours later there were cluster of hailstones as large as marbles still lying under the yew trees, although the temperature was about 65° F.

The majority of the stones were globular, but many were disc shaped, and the flatter, larger stones showed indications of conglomeration.

The destruction involved all glass of cucumber frames, rhubarb cut in holes and ribbons, early potato haulm flattened into the ground and late potato haulm very much torn, tomato plants, marrows and cucumbers were stripped and apples at least half torn off the trees. All flowers and half the leaves of trees were stripped—even gooseberries and small damsons being torn off.

ALFRED CARPENTER, Capt. R.N.

The Red House, Sanderstead, July 16th, 1918.

I HAVE a note from Mr. W. Clifford Smith, C.E., on the thunderstorm of July 16th at Cane Hill Asylum, the gist of which is as follows :—There was no hail as we ordinarily understand it, but flat, irregularly shaped pieces of ice from one to two inches in length and sometimes more, and about ¾ in thick. The fall of this ice began at 3.10 a.m. and lasted from seven to ten minutes, in which time it did damage to glass to the extent of £200, and to crops on the Asylum estate to the value of £1,000. These details you can take as reliable. Mr. Smith says that at 6.30 a.m. there had been collected from the gutters of the Asylum about three cubic yards of these pieces of ice, many of which still retained their flat faces. The ice did not fall until the thunderstorm had been in operation for an hour. He gives the limits of the fall about Cane Hill as the Chipstead Railway and Carshalton Hill on the north, Hollyme Road on the west, and the Valley beyond Farthing Downs on the south.

My rainfall here was only ·07 in., although I noted the storm as a severe one, but early during the night of the 17th -18th we had a wonderful display of lightning, and there appeared to me to be three distinct storms in south-east, south-west, and north-west. At times lightning was literally incessant and it wound up with very heavy rain, 1·02 in. being measured at 9 a.m. R. H. CURTIS.

"*St. Budeaux*," *Warlingham, July 29th, 1918.*

JULY 17th.

At 9 a.m. on the 18th inst. I registered 1·50 in. of rain, of which 1·35 in. fell in thirty minutes, between 6.50 and 7.20 p.m. on the 17th, during a severe thunderstorm, which passed over this district.

F. E. WRIGHT.

Hillsboro', Camborne Road, Sutton, July 19th, 1918.

In a storm, on July 17th, 1·02 in. of rain fell in forty-two minutes. The total rainfall for the day was 1·14 in. G. E. DACEY.

65, Clarendon Road, Lewisham, S.E.

The rainfall from 7 p.m to 8 p.m. during last evening's storm was 1·19 in. E. A. MARTIN.

285, Holmesdale Road, South Norwood, S.E., July 18th, 1918.

Heavy rain fell here from 7.20 p.m. to 8.10 p.m. (summer time), which registered 1·23 in. during the fall. G. B. HAMLIN.

283, The Broadway, Bexley Heath, Kent, July 17th, 1918.

I measured more rain in twenty-four hours on 17th July than I have ever done since keeping a rain gauge, now thirty years. Of the 2·53 in., more than 2 inches fell in the hour from 7 to 8 p.m. (G.M.T.)

The afternoon was very sultry with no wind whatever, and all that one could see was that it was getting darker and darker so that lamps had to be lit by 7 p.m. About 6.45 p.m. tremendous hollow-sounding rumbles began which sounded up above the clouds, and so far no lightning appeared to strike the earth; but almost at 7 p.m. the rain suddenly came down in torrents and the lightning and thunder were terrific. The rain appeared to cease a few minutes after 8 p.m., and only a slight drizzle kept on till about midnight, when all was fairly clear. I did not go out to take the measurement at 8 o'clock but I feel confident that not more than ·25 in. could have fallen after that time.

Three miles from here to the south-east in a direct line a road was blocked up with soil off a hilly field, and on the hill-side it was a yard deep tapering off to a foot on the road till it reached the stream.

There was about 200 yards of the road covered, but the worst part which I have described was about 100 yards. Five men, working with two tumbrels and horses, had been at work clearing away the soil for ten days, and then no waggon could pass, only a light

cart which could get on to the grass. This is the heaviest cloudburst I have known round here, and I believe from inquiry that the thunderstorm covered a very wide district. B. P. OAKES.

Hawkedon Rectory, Bury St. Edmunds, August 1st, 1918.

THE Buckland district experienced the heaviest hailstorm known to the oldest inhabitant: the stones were extraordinary for their size, and caused much havoc, not only among the glass in some of the larger grounds, but especially among the flowers and the vegetables. Many of the gardens were completely devastated, the hailstones cutting off the haulms of the potatoes, and damaging dwarf and runner beans and other products as if they had been slashed with a faggot. Tomatoes and cucumbers in the greenhouses were not even immune. The area between the "Red Lion" and Reigate Heath seems to have felt the full fury of the storm. In the Dorking neighbourhood, in many parts, the corn has suffered severely, especially where there was a promise of a heavy crop. In many instances the corn has been beaten down flat.—*Dorking Advertiser.*

July 20th, 1918.

RAINFALL OF JULY 17th.

Tilbury	7.30 to 9 p.m. ..	1 hr. 30 min. ..	1·50 in.
Old Ford	6·55 „ 8.45 „ ..	1 „ 50 „ ..	1·53 „
	6.55 „ 7.35 „ ..	40 „ ..	1·34 „
Shad Thames	6.15 „ 8·5 „ ..	1 „ 50 „ ..	2·32 „
	6.20 „ 6.50 „ ..	30 „ ..	2·07 „
Clapton Pond	5.45 „ 7.25 ..	1 „ 40 „ ..	1·48 „
	5.45 „ 6.20 „ ..	35 „ ..	1·35 „
Barnes, Castlenau	Between 5 and 7 p.m...	40 „ ..	·41 „

JULY 20th.

PERHAPS you will like to have some remarks on the severe storm here, on Saturday, the 20th inst. The day was fine, though not settled. Thunder was first heard about 4.20 p.m. (summer time). The main fall of rain was from about 7.2 to 8.30 p.m., when 1·79 in. was measured—also I measured ·21 in. about 10.14 p.m. At 10 a.m. on the 21st, I measured ·08 in., so that the total for the day was 2·08 in. The duration of the heavy fall was one feature; also the thunder, which was heavy and frequent, chiefly between 7.12 and 7.41 p.m. No hail of any importance was observed.

The storm caused flooding and I have heard of a waterspout.

JAS. EDESON.

Clinton Villas, Worksop, 29th July, 1918.

RAINFALL OF JULY 20th.

Worksop (Hodsock Priory) .... 10 min. .. ·53 in.
„ (Gateford Hill) ..... 4 hours .. 2·50 „

METEOROLOGICAL OBSERVATIONS AT LU-KIA-PANG, CHINA, FOR 1917.

By Rev. J. De Moidrey, S.J.

(*Continued from page 56*).

III.—*Relative Humidity. Per cent.*

	RELATIVE HUMIDITY.			VAPOUR TENSION.		
	Mean.	Lowest.	Highest.	Mean.	Lowest.	Highest.
Jan.	70	50	92	*3·2*	*1·3*	5·3
Feb.....	68	48	93	4·1	2·2	7·1
Mar.	69	51	96	5·6	3·2	8·8
April	*64*	*36*	97	8·0	4·8	11·2
May	**64**	39	97	10·8	6·9	15·6
June	83	67	97	18·9	12·4	25·3
July.....	**84**	67	95	**23·1**	18·5	**27·9**
Aug.	81	65	94	22·5	17·1	26·4
Sept.	**84**	72	95	19·4	11·9	26·0
Oct.	79	58	98	11·9	5·7	15·0
Nov.	76	63	**99**	7·0	4·3	12·6
Dec.	72	54	96	4·3	1·7	9·7
Year	74	36	99	11·6	1·3	27·9

VI.—*Rainfall.*

	(*a.*) INTENSITY. Days with								Days with		
	mm. 0·1— 0·9	1·0— 2·9	3·0— 4·9	5·0— 9·9	10·0—19·9	20·0—39·9	40·0—59 9	60·0 & over	Rain.	Snow.	Total.
Jan	3	2	—	1	—	—	—	—	*4*	2	6
Feb.....	2	2	—	2	—	—	—	—	*4*	1	5
Mar.	3	2	1	3	1	—	—	—	9	—	9
April	4	2	1	1	1	—	—	—	9	—	9
May.....	4	2	2	3	1	—	—	—	11	—	11
June	3	5	—	1	3	1	—	2	15	—	15
July.....	—	2	1	3	—	1	1	—	8	—	8
Aug.	4	—	2	2	1	3	—	—	10	—	10
Sept.	7	1	2	3	2	1	—	—	13	—	13
Oct.	5	2	1	—	3	1	—	—	8	—	8
Nov.	5	3	—	—	—	—	1	—	5	—	5
Dec.	2	2	—	—	1	—	—	—	*4*	—	*4*
Year	42	25	10	19	13	7	2	2	100	3	103

VI.—(con.)

(b.) *Total Rainfall. Millimeters.*

	8 p.m. –8 a.m.	8 a.m. –8 p.m.	Total.
Jan.....	*3·1*	*8·6*	*11·7*
Feb. ..	5·9	9·8	15·7
Mar. ...	36·0	12·7	48·7
April ..	16·3	10·7	27·0
May....	24·1	21·9	46·0
June ...	134·5	149·2	283·7
July ..	58·7	63·9	122·6
Aug. ...	48·4	54·0	102·4
Sept. ..	66·9	17·5	84·4
Oct. ...	26·3	8·8	35·1
Nov. ...	19·2	31·0	50·2
Dec. ..	9·6	9·5	19·1
Year ...	449·0	397·6	846·6

(c.) *Rainless Periods of 10 days or more, excluding dew.*

Began.	Ended.	Lasted.
Jan. 2	Jan. 21	20 days
Mar. 19	April 9	22 „
Oct. 5	Oct. 22	18 „
Nov. 8	Nov. 29	22 „
Dec. 2	Dec. 11	10 „
Dec. 15	*	

*The last rainless period was not ended when sending the report, on February 2nd, 1918, 50 days.

VIII.

Mean Duration of Bright Sunshine. Hours.

	Fore-noon.	After-noon.	Total.	Per-centage of possible.	Mean amount of Cloud.
Jan. ...	3·3	3·1	6·4	62	0·4
Feb. ..	2·9	2·8	5·7	51	0·5
Mar. ...	3·3	3·0	6·3	52	0·5
April ..	3·0	2·8	5·8	44	0·6
May....	3·6	3·4	7·0	51	0·5
June ...	2·2	2·0	4·2	*30*	0·7
July ..	3·5	3·0	6·5	47	0·5
Aug. ...	4·0	3·8	7·8	59	0·4
Sept. ..	3·0	2·6	5·6	45	0·5
Oct. ...	2·4	1·6	4·0	35	0·6
Nov. ...	2·7	2·6	5·3	50	0·5
Dec.* ..	—	—	—	—	—
Year* ..	3·1	2·8	5·9	48	0·9

VII.—*Wind* (a.)

Mean Velocity at 8 a.m., 2 p.m. and 8 p.m. Metres per second.

	Mean.	Min.	Max.
Jan. ...	3·8	8·8	7·3
Feb. ...	3·5	0·4	8·2
Mar.....	3·4	1·1	5·4
April ...	3·7	1·2	8·1
May ...	3·4	1·3	6·1
June ...	2·9	1·0	4·9
July ...	4·4	1·7	7·9
Aug. ..	*2·4*	0·3	6·9
Sept. ...	3·3	0·9	7·9
Oct. ...	*2·4*	0·3	4·0
Nov. ..	2·6	*0·0*	6·1
Dec. ..	3·5	0·7	7·3
Year ..	3·3	0·0	8·2

VII.—*Wind.* (b.) *Direction. Percentage Frequency.*

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Vari able
Jan.....	13	7	*6*	8	4	6	13	39	4	*0*
Feb.....	20	15	13	12	5	5	4	15	8	2
Mar.....	20	13	11	21	4	6	4	15	5	1
April	6	15	19	24	6	11	3	9	7	1
May	5	13	9	22	15	16	10	5	3	1
June	3	13	24	28	11	8	2	3	7	*0*
July.....	3	6	17	46	18	6	*1*	*2*	*1*	*0*
Aug.	*2*	13	18	15	10	12	3	9	17	*0*
Sept.	21	21	8	20	7	*2*	2	10	6	2
Oct.	19	24	15	5	*1*	*2*	7	14	12	*0*
Nov.	20	8	7	3	3	4	7	22	24	*0*
Dec.	13	*4*	9	*2*	4	3	14	40	9	2
Year	12	13	13	17	7	7	6	15	9	1

* Sunshine recorder was under repair. Yearly means are not correct.

ERRATUM.—Vol. 52, p. 68—last line of table VII., Col. 1—*For* 22 *read* 15.

REVIEW.

Observations Météorologiques, 1917. By A. Collenette, Guernsey, 1918. Size, 11 × 8½. Pp. 16. One plate.

Mr. Collenette's fifteenth annual report on the climate of Guernsey—a subject which he has made peculiarly his own, is of especial interest as containing a large scale map of the distribution of average rainfall over the island. The method followed is somewhat original, the isopleths representing not the actual rainfall but the percentage of the fall at the standard station at St. Martin's Road, where observations are available for the long period of seventy-five years. This station, with an average annual fall of 36·7 inches, is, it appears, the rainiest spot in the island, and the map shows a fairly uniform falling off in all directions, the rainfall being below 90 per cent. of the standard in the western half of the island, and along the north coast, and less than 80 per cent. in the extreme west. The map is put forward, we gather, only as a first approximation to the true distribution, but Mr. Collenette's intimate knowledge of the climatic conditions of Guernsey, coupled with the care he has lavished on the observing stations, of which a tour, under Mr. Collenette's guidance gave us recent evidence, give great weight to his expression of opinion on the subject. C.S.

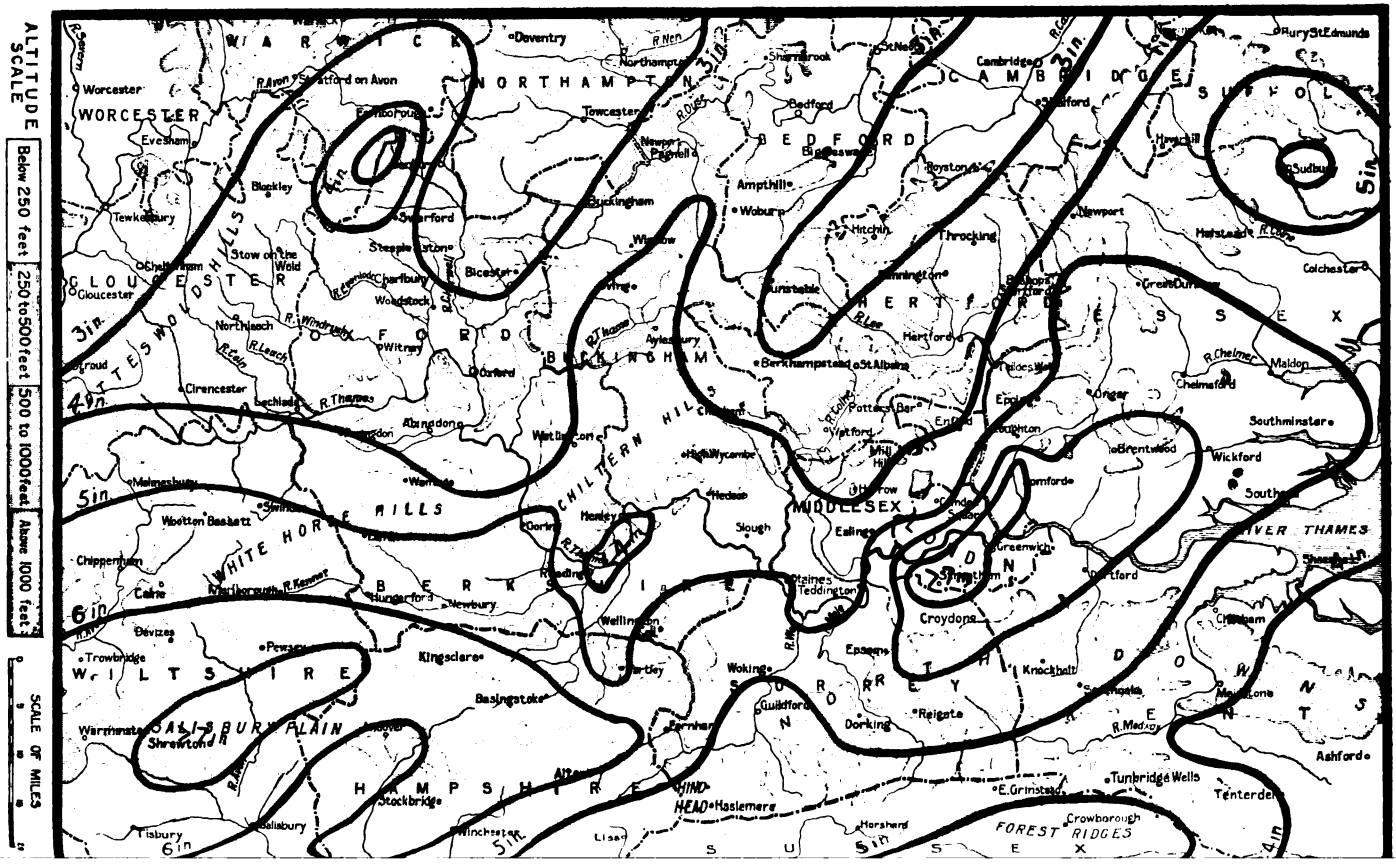
METEOROLOGICAL NEWS AND NOTES.

At the Annual Meeting of the Trustees of the British Rainfall Organization, held at 62, Camden Square, on July 31st, Mr. Carle Salter, the Assistant-Director of the Organization, was appointed Joint-Director with Dr. H. R. Mill, for the period during which Dr. Mill continues to be Director, or for such shorter period as may be determined by the Trustees. Mr. Salter has been connected with the British Rainfall Organization as Assistant, Chief Assistant and Assistant-Director for twenty-one years, having joined the Staff in the time of the Founder of the Organization, Mr. G. J. Symons.

Mr. A. Pearse Jenkin, F.R.Met.Soc., read a paper, entitled, "Suggestions for a Rainfall Map of Cornwall," at the Summer meeting of the Royal Cornwall Polytechnic Society at Falmouth, on July 30th. He laid stress on the importance of an exact knowledge of the distribution of average annual rainfall, and pointed out that the preparation of a satisfactory rainfall map of Cornwall was rendered difficult by the existence of wide stretches of country without any observing stations. He urged the importance of establishing new rainfall stations in such areas.

British Rainfall, 1917, is now complete, and the MS. is in the printer's hands, but difficulties of production will delay the publication until a period at least as late as it was last year.

THAMES VALLEY RAINFALL. JULY, 1918



THE WEATHER OF JULY.

THE month opened with about a week of fine summer weather, and a mean temperature slightly above the average in all but the north-western and extreme northern parts of the United Kingdom. On the 1st, and again on the 7th or 8th, the thermometer rose to between 75° and 80° over the inland portions of England, and on the former date it touched 84° (in the Glaisher screen) at Camden Square.

The distribution of barometric pressure was at the time anticyclonic, but after the 7th a marked change took place, and for about three weeks the weather was influenced by numerous depressions which came in, at first from the northern, and afterwards from the more central portions of the North Atlantic. The accompanying winds were often light and variable, but as a rule blew from some easterly quarter in the north, and from the southerly to westerly quadrant in the south. In Scotland the air was, therefore, cool for the time of the year. Early on the 10th the sheltered thermometer sank to 30° at Balmoral, and 28° at West Linton, the minimum readings on the grass being in each case a couple of degrees lower than those in the screen. Over the major part of England and Ireland the mean temperature agreed pretty closely with the average, an exception occurring on the 16th and 17th, when the thermometer rose to 80° or slightly above it at a few isolated spots in East Anglia. During this long spell of cyclonic weather, rain was frequent and often very heavy, more especially in the southern and south-eastern portions of the London district, where the total fall in eighteen or nineteen days was largely in excess of anything previously recorded in any complete July. An equally striking feature in connection with this long spell of disturbed weather was the abnormal frequency of thunderstorms, accompanied in many instances by torrential falls of rain or hail. At a large number of stations in England thunder occurred on at least seven or eight days, and at Richmond and Yarmouth on nine days, the number recorded at Kew Observatory being greater than in any July since the year 1880, when twelve days were affected.

After about the 27th an anticyclone extended over the United Kingdom from the south-westward and occasioned a decided improvement in the weather and a general increase of temperature. On the 31st the thermometer rose to 80° or slightly above it in several English districts, and touched 82° at Clifton (Bristol) and Jersey.

In spite of so much unfavourable weather the total duration of bright sunshine over the country, as a whole, was in excess of the average, but at a few places in the eastern and south-eastern portions of Great Britain there was a slight deficit.

The total rainfall of the month was in excess of the average in nearly all parts of the British Isles, and was exceptionally large in the south of England and in the east of Scotland, where rather more than double the average fell at one or two stations. As will be clear from the correspondence which we publish this month thunderstorms of a remarkable nature occurred in the south, principally to the south of London, where a number of stations experienced a total rainfall exceeding 7 inches in the month. More than 6 inches fell over a strip of country extending from Devonshire to Essex, a portion of which comes within the scope of the map of the Thames Valley facing this page. Less than 3 inches of rain fell over a part of the English Midlands, but more than 4 inches over the greater part of the country, practically everywhere in Scotland, and over the most of Ireland. The general rainfall of the countries expressed as a percentage of the average was :—England and Wales, 146; Scotland, 141; Ireland, 126; British Isles, 140.

In London (Camden Square) the mean temperature was 63°·0, or 0°·5 below the average. The duration of bright sunshine was 163·2 hours, and of rainfall, 47·2 hours. The total evaporation was 2·59 in.

RAINFALL TABLE FOR JULY, 1918.

STATION.	COUNTY.	RAINFALL. Aver. 1875–1909. in.	1918. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·57	4·74	+2·17	185	·56	26	18
Tenterden	*Kent*	2·21	3·59	+1·38	163	·98	20	15
Arundel (Patching)	*Sussex*	2·46	4·73	+2·27	192	...	...	14
Fordingbridge (Oaklands)	*Hampshire*	2·14	4·68	+2·54	219	·73	17	17
Oxford (Magdalen College)	*Oxfordshire*	2·43	4·12	+1·69	169	·63	17	16
Wellingborough (Swanspool)	*Northampn*	2·54	2·81	+ ·27	111	·67	17	17
Bury St. Edmunds (Westley)	*Suffolk*	2·68	4·24	+1·56	159	1·93	17	16
Geldeston [Beccles]	*Norfolk*	2·37	3·76	+·139	159	·89	17,20	19
Polapit Tamar [Launceston]	*Devon*	2·74	4·12	+1·38	150	·89	22	19
Rousdon [Lyme Regis]	,,	2·68	4·92	+2·24	184	·88	22	19
Stroud (Field Place)	*Gloucester*	2·75	2·95	+ ·20	107	·44	26	19
Church Stretton (Wolstaston)	*Shropshire*	2·58	2·81	+ ·23	109	·68	15	16
Boston	*Lincoln*	2·35	2·86	+ ·51	122	·99	17	18
Worksop (Hodsock Priory)	*Nottingham*	2·35	3·64	+1·29	155	1·09	20	18
Mickleover Manor	*Derbyshire*	2·57	3·23	+ ·66	126	·58	26	18
Congleton (Buglawton Vic.)	*Cheshire*	3·03	3·70	+ ·67	122	·56	20	19
Southport (Hesketh Park)	*Lancashire*	2·92	4·06	+1·14	139	·48	17	16
Wetherby (Ribston Hall)	*York, W.R.*	2·56	3·78	+1·22	148	·63	18	16
Hull (Pearson Park)	,, *E.R.*	2·39	3·31	+ ·92	138	1·07	16	18
Newcastle (Town Moor)	*North'land*	2·90	4·00	+1·10	138	·71	16	18
Borrowdale (Seathwaite)	*Cumberland*	8·91	...	...	...	...	...	...
Cardiff (Ely)	*Glamorgan*	3·26	5·54	+2·28	170	·85	22	19
Haverfordwest	*Pembroke*	3·39	5·19	+1·80	153	1·18	17	17
Aberystwyth (Gogerddan)	*Cardigan*	4·03	4·85	+ ·82	120	·75	15	17
Llandudno	*Carnarvon*	2·52	2·54	+ ·02	101	·51	15	18
Cargen [Dumfries]	*Kirkcudbrt.*	3·20	3·94	+ ·74	123	·81	15	19
Marchmont House	*Berwick*	3·30	3·14	— ·16	95	·85	20	15
Girvan (Pinmore)	*Ayr*	3·73	3·80	+ ·07	102	1·30	20	18
Glasgow (Queen's Park)	*Renfrew*	2·91	3·07	+ ·16	106	·57	23	19
Islay (Eallabus)	*Argyll*	3·41	3·59	+ ·18	105	·49	22	20
Mull (Quinish)	,,	4·12	4·96	+ ·84	120	·76	22	21
Balquhidder (Stronvar)	*Perth*	4·34	3·75	— ·59	86	1·00	22	17
Dundee (Eastern Necropolis)	*Forfar*	2·84	5·54	+2·70	195	1·14	20	18
Braemar	*Aberdeen*	2·65	6·62	+3·97	250	1·65	17	17
Aberdeen (Cranford)	,,	3·00	6·42	+3·42	214	1·40	21	17
Gordon Castle	*Moray*	3·25	5·02	+1·77	154	·97	21	20
Drumnadrochit	*Inverness*	3·37	5·04	+1·67	150	·80	17	18
Fort William	,,	4·92	4·65	— ·27	95	·66	7	20
Loch Torridon (Bendamph)	*Ross*	5·35	8·97	+3·62	168	1·31	12	21
Dunrobin Castle	*Sutherland*	2·91	6·93	+4·02	238	1·48	11	17
Glanmire (Lota Lodge)	*Cork*	2·73	4·68	+1·95	171	·86	21	21
Killarney (District Asylum)	*Kerry*	3·53	4·10	+ ·57	116	·86	31	22
Waterford (Brook Lodge)	*Waterford*	3·13	3·03	— ·10	97	·83	21	19
Nenagh (Castle Lough)	*Tipperary*	3·02	5·09	+2·07	169	·73	13	22
Ennistymon House	*Clare*	3·57	5·94	+2·37	166	·77	31	21
Gorey (Courtown House)	*Wexford*	2·90	2·67	— ·23	92	·62	21	18
Abbey Leix (Blandsfort)	*Queen's Co.*	2·99	3·62	+ ·63	120	·49	14	20
Dublin (Fitz William Square)	*Dublin*	2·60	2·76	+ ·16	106	·47	12	18
Mullingar (Belvedere)	*Westmeath*	3·16	4·07	+ ·91	129	·87	14	18
Crossmolina (Enniscoe)	*Mayo*	3·26	4·81	+1·55	148	·69	7	22
Cong (The Glebe)	,,	3·72	4·23	+ ·51	114	·74	31	20
Collooney (Markree Obsy.)	*Sligo*	3·36	3·31	— ·05	99	·53	7	22
Seaforde	*Down*	3·32	4·76	+1·44	143	1·02	17	17
Ballymena (Harryville)	*Antrim*	3·44	4·16	+ ·72	121	·66	22	18
Omagh (Edenfel)	*Tyrone*	3·34	3·48	+ 14	104	·57	25	19

SUPPLEMENTARY RAINFALL, JULY, 1918.

Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	5·48
,,	Ramsgate	3·60
,,	Hailsham	4·70
,,	Totland Bay, Aston House...	3·28
,,	Stockbridge, Ashley..	6·19
,,	Grayshott	4·77
III.	Harrow Weald, Hill House...	3·41
,,	Pitsford, Sedgebrook	2·87
,,	Woburn, Milton Bryant	3·72
,,	Chatteris, The Priory	2·57
IV.	Elsenham, Gaunts End	4·96
,,	Shoeburyness	4·74
,,	Colchester, Hill Ho., Lexden	4·67
,,	Ipswich, Rookwood, Copdock	3·87
,,	Aylsham, Rippon Hall	3·58
,,	Swaffham	3·40
V.	Bishops Cannings	6·27
,,	Weymouth	3·59
,,	Ashburton, Druid House	5·33
,,	Cullompton	4·36
,,	Lynmouth, Rock House	4·63
,,	Okehampton, Oaklands	4·37
,,	Hartland Abbey	4·77
,,	St. Austell, Trevarna	5·10
,,	North Cadbury Rectory	6·14
VI.	Clifton, Stoke Bishop	5·54
,,	Ledbury, Underdown	2·39
,,	Shifnal, Hatton Grange	3·37
,,	Droitwich	2·44
,,	Blockley, Upton Wold	3·26
VII.	Grantham, Saltersford	2·62
,,	Louth Westgate	...
,,	Bawtry, Hesley Hall	3·71
,,	Whaley Bridge, Mosley Hall	4·21
,,	Derby, Midland Railway	2·46
VIII.	Nantwich, Dorfold Hall	3·62
,,	Bolton, Queen's Park	4·18
,,	Lancaster, Strathspey	4·85
IX.	Langsett Moor, Up. Midhope	2·88
,,	Scarborough, Scalby	4·68
,,	Ingleby Greenhow	4·56
,,	Mickleton	4·40
X.	Bellingham, High Green Manor	4·29
,,	Ilderton, Lilburn Cottage	3·59
,,	Keswick, The Bank	4·35
XI.	Llanfrechfa Grange	...
,,	Treherbert, Tyn-y-waun	9·43
,,	Carmarthen, The Friary	5·80
,,	Fishguard, Goodwick Station.	4·16
,,	Crickhowell, Tal-y-maes	4·00
,,	Gwernargllwydd	2·00
,,	Birmingham WW., Tyrmynydd	5·11
,,	Lake Vyrnwy	6·19
,,	Llangynhafal, Plas Drâw	3·35
,,	Rhwibryfdir	13·53
,,	Dolgelly, Bryntirion	4·02
XI.	Lligwy	4·17
,,	Douglas, Isle of Man	3·21
XII.	Stoneykirk, Ardwell House...	2·34
,,	Carsphairn, Shiel	5·37
,,	Langholm, Drove Road	5·99
XIII.	Selkirk, The Hangingshaw..	4·04
,,	North Berwick Reservoir	3·81
,,	Edinburgh, Royal Observaty.	3·56
XIV.	Biggar	3·47
,,	Maybole, Knockdon Farm	2·47
XV.	Buchlyvie, The Manse	3·22
,,	Ardgour House	7·40
,,	Oban	3·93
,,	Campbeltown, Witchburn	...
,,	Holy Loch, Ardnadam	4·57
,,	Tiree, Cornaigmore	...
XVI.	Glenquey	4·90
,,	Loch Rannoch Dall	4·29
,,	Blair Atholl	5·49
,,	Coupar Angus	5·88
,,	Montrose, Sunnyside Asylum.	4·32
XVII.	Balmoral	5·52
,,	Fyvie Castle	7·48
,,	Keith Station	4·79
XVIII.	Rothiemurchus	4·97
,,	Loch Quoich, Loan	12·60
,,	Skye, Dunvegan	5·84
,,	Fortrose	2·94
,,	Glencarron Lodge	6·07
XIX.	Tongue Manse	5·67
,,	Melvich	5·93
,,	Loch More, Achfary	7·94
XX.	Dunmanway, The Rectory	5·92
,,	Mitchelstown Castle	3·53
,,	Gap of Dunloe Gearahameen	7·30
,,	Darrynane Abbey	5·35
,,	Clonmel, Bruce Villa	3·50
,,	Broadford, Hurdlestown	5·05
XXI.	Enniscorthy, Ballyhyland	4·31
,,	Rathnew, Clonmannon	2·59
,,	Ballycumber, Moorock Lodge	4·10
,,	Balbriggan, Ardgillan	3·20
,,	Castle Forbes Gardens	2·83
XXII.	Ballynahinch Castle	6·18
,,	Woodlawn	3·77
,,	Westport, St. Helens	2·95
,,	Dugort, Slievemore Hotel	3·78
XXIII.	Enniskillen, Portora	...
,,	Dartrey [Cootehill]	5·29
,,	Warrenpoint, Manor House	5·11
,,	Belfast, Cave Hill Road	4·19
,,	Glenarm Castle	3·36
,,	Londonderry, Creggan Res...	3·57
,,	Milford, The Manse	...
,,	Killybegs	4·14

Climatological Table for the British Empire, February, 1918.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	59·2	23	22·9	18	49·2	38·4	...	88	100·5	21·3	1·11	16	7·6
Malta	61·9	25	45·6	18	57·5	50·1	...	78	114·0	31·4	1·08	10	2·6
Lagos	91·0	17	68·5	1	88·6	74·9	72·4	73	145·3	65·0	3·66	2	5·3
Cape Town	99·1	13	54·1	3	82·6	61·6	58·0	62	...	...	4·76	2	2·4
Johannesburg	80·1	16	44·8	11	73·6	55·0	56·9	85	...	44·1	15·06	15	6·4
Mauritius	86·2	14	65·8	18	82·5	71·3	70·2	81	...	61·0	10·60	24	6·4
Bloemfontein	95·7	16	48·9	1	85·2	59·4	56·0	61	..	...	2·94	7	4·6
Calcutta...	92·0	28	49·7	1	85·1	58·8	54·4	57	...	39·1	·00	0	0·5
Madras	94·5	15	60·3	15	85·5	66·3	66·2	75	157·1	56·6	2·18	2	1·8
Colombo, Ceylon ...	90·3	12*a*	63·4	18	86·3	68·3	65·8	73	159·1	53·3	·10	2	2·9
Hongkong	72·2	26	50·0	19	64·5	55·7	50·4	71	...	...	·02	1	5·1
Sydney	92·0	9	56·0	24	76·6	63·6	60·5	69	150·0	52·2	4·88	15	6·0
Melbourne	98·8	11	49·4	27	78·3	58·0	55·1	62	152·3	41·2	1·08	11	4·8
Adelaide	109·2	11	45·5	23	85·8	61·6	52·9	45	162·2	36·7	·19	4	4·3
Perth	93·6	16	55·3	12	83·5	65·8	63·1	66	162·9	47·1	1·21	5	4·6
Coolgardie	102·0	18	47·8	12	86·4	64·1	55·3	50	166·4	46·0	2.43	11	5·8
Brisbane	96·1	4	62·1	16	83·4	67·4	64·4	71	155·3	58·6	2·25	11	5·3
Hobart, Tasmania ..	88·1	12	46·1	26	71·9	54·3	50·3	62	144·6	40·2	1·80	11	5·7
Wellington ...	79·3	6	51·0	20	71·8	59·5	55·6	73	154·0	42·3	5·04	8	6·8
Jamaica, Kingston ..	88·8	28	64·6	21	85·0	67·6	65·3	76	...	...	·52	7	4·0
Grenada	84·0	10, 11	69·0	1, 22	82·0	71·0	...	76	138·0	...	3·35	19	4·0
Toronto	48·8	20	—20·2	5	30·7	11·6	15·5	85	110·2	—26·2	4·05	15	6·0
Fredericton	48·0	20	25·5	22	24·0	—2·2	4·5	83	...	...	3·41	16	5·6
St. John, N.B. ...	48·1	25	—14·0	6	26·6	7·6	10·7	75	104·5	—14·9	4·60	19	5·8
Victoria, B.C.	51·8	3, 5	25·4	18	43·9	35·2	33·0	77	104·0	18·0	3·87	19	7·1
Mauritius (January)	88·0	10	67·7	4	84·8	71·7	68·2	73	...	60·7	5·28	20	5·5

a—17.

Malta.—Crops suffering for want of rain. If drought continues, crops will be damaged, and the storage of water considerably decreased.

Johannesburg.—Bright sunshine 194·5 hours.

COLOMBO, CEYLON.—Mean temp. 77°·3, or 2°·3 below, dew point 4·4 below, and R 1·86 in. below, averages. Mean hourly velocity of wind 5·5 miles.

HONGKONG.—Mean temp. 59·2. Bright sunshine 203·6 hours. Mean hourly velocity of wind 14·4 miles.

Sydney.—Unsettled with rain and cool S. winds. Fine toward the end.

Melbourne.—Temp. 0°·8 above, and R ·62 in. below, averages.

Adelaide.—Mean temp. 0·4 in. below, and R ·44 in. below, averages.

Brisbane.—R 4·32 in. below average.

Wellington.—Mean temp. 3°·3 above, and R 1·77 in. above, average. Bright sunshine, 158·5 hours.

Symons's
Meteorological Magazine.

No. 632. SEPTEMBER, 1918. Vol. LIII.

THE WATER POWER OF THE BRITISH EMPIRE.

Physical geography includes the study of the forms of the land and the circulation of water through the air; rainfall research is concerned with just those portions of physical geography, and the application of rainfall research to practical problems is required in all questions of the utilizations of water for the supply of towns, the production of power, the conservation of rivers, the maintenance of canals, as well as in agriculture and public health. While the observation of rainfall has always been part of the routine of meteorological stations, the main value of rainfall records is in reality less meteorological than geographical. The distinction may, perhaps, best be seen by reflecting that meteorology is concerned mainly with *why* rain falls, geography with *where* it falls and whither it flows.

The use of water in the production of power depends practically less on the amount of water power available than on the cost of it as compared with other sources of power. Hence it may be said that the price of coal and mineral oil regulate the demands on the water power of a country. Where coal is abundant and cheap water power is naturally neglected; but where coal is difficult to obtain and costly the existence of water power becomes very interesting to the industrial world. Hence, at this time when coal-supplies are short everywhere and coal-prices are rising week by week there is a general awakening to the importance of exploring the water-power resources of the world. To the scientific man it often seems that the practical man opens his eyes too late to the importance of unused resources. In the *Geographical Journal* for April, 1896, more than twenty years ago, we elaborated a scheme for the complete geographical description of the British Isles with special reference to the survey of natural resources, and the time

estimated for the completion of the work was twenty years. Had the scheme, which perished in a general chorus of praise of its promise, been carried out, the Ministry of Reconstruction would now have before it a mass of elaborated data, the like of which cannot now be obtained in time to guide the after-war development of the country. It is not too much to say that many millions of public money would have been saved during the war in public works begun in panic hurry and abandoned only when failure became the reward of ignorance.

Late though it is, the country seems to have fairly awakened to the importance of water power, and we have before us the Preliminary Report of the Water Power Committee (formerly called Sub-committee) of the Conjoint Board of Scientific Societies, presided over by Sir Dugald Clerk, F.R.S., with Professor A. H. Gibson as Secretary. It consists of 28 pp., and its importance demands a brief summary here.

The Committee was appointed "to report on what is at present being done to ascertain the amount and distribution of water power in the British Empire," but this purpose was interpreted to include the preliminary results as well as the existing agencies for acquiring information, and even to enter into the general question of water power and its utilization.

The Report begins with the consideration of the world's present power demands in steam, gas and water-power, and this is stated as about 120 million horse-power, of which 75 million are required for factories, including the output of electricity, 21 million for railways and 24 million horse-power for the world's shipping. Of the 75 million horse-power required in the world, the United States is responsible for 29 million, the United Kingdom for 13 million, and the rest of the British Empire for 6 million. Of the amount of power utilized in various parts of the world water power amounts to much less than 1 per cent. in the United Kingdom, to 24 per cent. in the United States, 27 per cent. in continental Europe and to 33 per cent. in the British Dominions and dependencies. In Germany the Report states 43·4 per cent. of the industrial horse-power is derived from water.

Having shown the extraordinary backwardness of the United Kingdom in the present use of water power, the Report goes on to consider the probable available water power of the British Empire, though it is acknowledged that the paucity of data, save for two of the Dominions, makes such an estimate "highly speculative." First attention is given to the forms of industrial activity to which water power may be applied effectively, and these are practically all dependent on electricity, the generation of which is the first stage in all modern applications of water power. Electric power may be transmitted to any distance, the only limitation being financial, and at present there are transmission lines of as much as

200 miles in existence. In addition to its use for running machinery, including railways, electricity has a great future in metallurgical and chemical operations, such as the manufacture of aluminium and carbide of calcium, and, perhaps most important of all, the fixation of atmospheric nitrogen for the production of explosives and fertilizers, the paramount essentials for war and peace. In this work at present 400,000 horse-power are being used from water in Norway alone. The demand is enormous and increasing. One very attractive feature of this industry is that the raw material exists everywhere in the air in inexhaustible quantities, and that the product is so valuable in proportion to its bulk that it can afford to pay a considerable amount for transport; hence factories can be erected near the source of power even at considerable distances from centres of population.

In view of the great possibilities presented by the use of water power and the complex questions of law, administration and engineering that are involved, the Report states :—

"In view of the immensity of the interests involved it is urged that nothing short of statutory control of these developments is desirable. The exact method of control is not for the Committee to suggest. So far as is possible private enterprise should be encouraged, but under conditions which would prevent the perpetual rights being lost to the community."

The cost of power is, it is pointed out, a relative matter, and changes of conditions might make possible in the future the development of sources which it would not pay to deal with at present. An examination of 120 European installations shows that where upwards of 10,000 horse-power is developed the cost is on the average in the neighbourhood of £10 10s. per electrical horse-power per annum.

Great stress is laid in the Report on the necessity for preliminary investigations before the development of water power can be taken in hand on a great scale. It is clear that there may be abundant water power in a locality where circumstances make its utilization too costly to be practicable at present, though in future conditions the cost might be justified. While in most cases the usefulness of a water supply depends on maintaining its uniformity over the whole year, there are cases in which supplies that vary with the seasons may be utilized for work that does not need to be continuous. In any case an investigation to be of real service must extend over a number of years. Perhaps the Report may be considered by some physical geographers a little too didactic in the statement "Rainfall records, though forming the basis of any such investigation, are only of partial assistance in dealing with water-power questions. The actual run-off from the catchment area is the all-important factor, and the ratio of run-off to rainfall varies with the physical characteristics of the area, the vegetation, and the climate, so that

rainfall gaugings cannot be substituted for the more laborious and costly collection of continuous records of river levels, combined with frequent gaugings of flow." Possibly more general acceptance would be given to the dictum :—" If a reasonably long record of rainfall exists, the determination of the run-off for a few years will serve to give a relation between precipitation and run-off which can be carried back as far as the rainfall records go."

Space does not allow us to give in detail the estimates of water power for the different parts of the British Empire. Suffice it to say that while valuable surveys of water power exist for the Dominions of Canada and New Zealand little in the way of a systematic census of power resources exists in other parts of the Empire, although approximate estimates may be given with a wide margin of error.

The Report proceeds to say, " It is a matter of urgent importance that the preparation of the necessary hydrographic and meteorological data should be undertaken at the earliest possible date in the remaining dominions and dependencies of the Empire.

" In this connection an adequate rainfall map is of great value and importance, and where, as is the case, for example, for the greater part of the British Isles, data for such a map are available, its preparation would appear to be most advisable."

The Report concludes with six recommendations, which may be summarized thus :—That the British Government bring before the other Governments of the Empire the necessity of an exact survey of water powers, ascertain if the respective Governments are prepared to undertake the work. Should they not be so prepared the British Government should place the work on an " Imperial Water Power Board " or " Conservation Commission," to be created including a representative from each Dominion or dependency. This Board should act in an advisory capacity. As it is unlikely that private capital for developing water power will be available for many years, the State should assist or undertake such development.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

ASHDOWN FOREST CLIMATOLOGY.

THE forest ridges of east Sussex probably offer the nearest approach to true mountain scenery of the softer woodland type, that is to be found within 100 miles of London.

During a rainy walk on a July day, from Uckfield to Forest Row, over the Ashdown Forest Ridge and back by another and wilder route, we particularly noted the following climatic features :—

(1.) The transition on both sides of the ridge between the heather and pine forest of the upper slopes and the richly tangled oak forest of the lower is very sharp, an indication, we thought, that the climatic factor in the altitudinal distribution was only secondary to the edaphic or geological.

(2.) Both at Nutley, on the south side of the ridge, and at Forest Row, on the north side, a snow plough was conspicuously set in the village green, a fine indication we observed of bleak country, since snow ploughs are not usually so obtrusive in Thames Valley villages.

(3.) The warm, south-easterly wind rain that had set in before we left Uckfield, at 9 a.m., continued till we reached the summit of the range, but soon afterwards it seemed to degenerate into a true moorland drizzle, all scenery in the higher zone being blotted out by thick hill-mist driving along much as in the high hill regions of the west and north of England. As the day wore on the weather gradually improved in the surrounding lower country, but the Ashdown ridge remained thickly enveloped in mountain mist through which on our return journey an occasional smart spurt of true rain would fall. We came to the conclusion that on this day the orographic factor of condensation was very prominent on Ashdown Forest, and that on a range of only moderate elevation of barely 1,000 feet this factor could only be conspicuous on days of more or less general rainfall. Again we had an example of the observation so often made that hill-mist and true rainfall are only with difficulty associated. The sudden short spurts of true rain, referred to above, we ascribed to the passage of *general* showers produced at a higher level and falling through the hill-born mist. Six days later, on the contrary, during heavy rain of the thunder type, with no wind, there was no mist at all on Ashdown Forest, and from the top of the ridge the outline of the South Downs could be clearly seen through a fairly thick rain-sheet.

L. C. W. BONACINA.
M. A. GIBLETT.

A GREEN FLASH.

On going through my old meteorological record I came across the following note :—

" At sunrise on February 15th, 1906, the sky was clear of clouds with a low temperature, 30° F. below zero, there was a heavy wood smoke drifting from the chimneys, immediately after the limb of the sun appeared above the horizon a cloud of smoke passed between me and the sun, as it did so the small sector of sun that was visible turned a bright green ; the smoke rolled away, and when it rolled in front of the sun again there was about one-eighth of sun's diameter visible the green flash did not appear."

The above requires a little explanation. At that time the only fuel used was wood, with temperatures below zero the water vapour in wood smoke on coming into the air condenses and forms a somewhat thick white cloud. The house I was in was at higher elevation than the rest of the village, which stands on rising ground on the west side of Lake Temiskaming, which is five miles wide here, so that I had an uninterrupted view of the eastern horizon across the lake ; the smoke clouds were rolling slowly from the south, some of the puffs rising just high enough to cover the horizon so that the place of the rising sun was obscured intermittently. The point to be specially noticed is that the green flash came when only a very *small portion* of the sun was above the horizon, when one-eighth of the sun's diameter was visible no flash appeared.

PAUL A. COBBOLD, F.R.Met.Soc.

Haileybury, Ont., February 18th, 1918.

OUR RAINFALL TABLES.

Six hundred and thirty-one numbers of this Magazine have been issued during the last fifty-two years and never until to-day has the new number failed to contain statistical data of the preceding month. No. 632 appears without the Tables to which our readers are in the habit of turning, but the fault is not ours or our printers. We have striven against difficulties arising from the war for four years, and so far we have striven successfully, carrying out what we know to be a national service of real value. At times the labour and strain have almost proved too much for us ; but hitherto each difficulty has been met and surmounted as it occurred. The last difficulty, however, springs from one of those conditions against which "the gods themselves fight in vain " and we have to submit. Time will, no doubt, overcome this difficulty also, and when it does so the Tables and map missing from this number will be forwarded to all subscribers served from this office and supplied to the publishing agents for other purchasers.

VOLUNTARY OBSERVERS AND THE NEW STAR.

A NEW star in the constellation Aquila suddenly blazed up to the first magnitude on June 8th, and, after shining brilliantly for a few nights, gradually faded and has now become inconspicuous. The Astronomer Royal, writing to *The Times* on June 15th, handsomely acknowledges the value of amateur Observers, who, while on the outlook for meteors and variable stars, picked up Nova Aquilae in many cases before it had attained its maximum brilliancy. Our old friend, Mr. Denning, was one of the first to see the new star, but he was anticipated by a schoolboy of astronomical tastes. The value of early notice being given to professional astronomers of such an occurrence as the change in brilliancy of a star lies in the importance of following the changes with the spectroscope, and so ascertaining the true nature of the occurrence. It must, of course, be remembered that the professional astronomer is pinned down to specific duties which may compel him to devote all his attention to a particular quarter of the heavens. The wide-sweeping eye and the passion for finding something new are, perhaps, more common in the amateur, and it is recorded of one professional astronomer that when the new star caught his eye as he was going to his observatory he said to himself that there was something unfamiliar in the stars of that part of the sky, but set himself to his routine duties and forgot to call his chief's attention to the fact.

We have long felt that in many departments of science immense services may be rendered by enthusiastic Observers with no special knowledge but keen interest in phenomena. The professional specialist alone can make full use of the information collected by the army of amateurs, and perhaps he sometimes fails in acknowledging his debt. In meteorology even more than in astronomy the work of the amateur Observer is of the utmost value, and no one has more constant proof of this than the Director of the British Rainfall Organization.

METEOROLOGICAL NEWS AND NOTES.

PROFESSOR FILIPPI EREDIA has, says *Nature*, been awarded the Natural Sciences Gold Medal of the Societa Italiana delle Scienze for his important work in Meteorology, this being the first time that such a distinction has been awarded for meteorology in Italy.

THE METEOROLOGICAL OFFICE announces that the *Daily Weather Report*, the *Weekly Weather Report* and the *Monthly Weather Report* will not be issued to the public henceforth during the continuance of the War. Subscribers to these Reports may, on giving notice to the Director of the Meteorological Office, have their copies kept for them to be delivered at the end of the War.

Climatological Table for the British Empire, March, 1918.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	70·3	23	27·2	9	52·9	35·8	...	84	109·6	24·0	1·09	8	6·1
Malta	66·7	28	48·5	22	59·5	51·6	...	81	121·0	29·0	5·49	12	2·0
Lagos	90·4	2	68·0	18	87·3	75·3	73·3	75	153·4	65·0	7·86	14	7·4
Cape Town	92·1	12	50·8	25	77·3	58·0	56·0	68	...	...	·90	4	2·3
Johannesburg	77·5	10	46·2	23	70·6	54·1	55·4	87	...	47·2	4·73	23	7·9
Mauritius	86·4	10	65·0	4	83·5	70·7	70·4	81	...	14·8	11·43	21	6·0
Bloemfontein	86·6	10	48·9	2	77·1	60·2	68·7	72	..	...	3·28	11	6·2
Calcutta...	98·8	9	60·9	13	93·2	70·8	65·8	62	...	43·3	·82	2	1·8
Madras	91·7	21	66·6	12	87·8	70·6	71·1	78	156·2	62·2	·02	1	1·5
Colombo, Ceylon ...	90·2	17	69·6	2	88·4	73·2	71·3	78	158·5	63·3	1·85	6	4·2
Hongkong	78·2	25	54·1	15	68·6	60·7	58·3	81	...	...	1·11	10	7·7
Sydney	86·4	6	52·7	30	75·6	60·7	60·7	74	144·6	56·4	2·48	15	4·8
Melbourne	87·8	23	40·0	18	73·4	55·0	52·5	64	146·7	31·5	4·46	14	5·7
Adelaide	96·2	23	49·6	26*a*	80·0	57·6	50·6	50	153·0	35·5	·50	4	3·6
Perth	92·3	19	51·0	4	80·2	60·2	55·9	62	167·0	42·3	1·91	6	3·9
Coolgardie	93·8	7	47·8	6	82·3	57·4	49·4	46	153·6	46·0	1·01	6	3·6
Brisbane	84·8	15	58·0	26	79·1	64·0	61·6	72	151·9	52·8	3·05	20	5·6
Hobart, Tasmania ..	87·3	23	40·4	16	68·5	51·9	47·2	60	140·8	34·7	1·38	13	5·8
Wellington ...	76·3	8	43·7	25	66·7	55·1	53·2	76	139·0	31·6	3·50	11	7·2
Jamaica, Kingston ..	87·5	9, 11	65·3	7	85·3	67·6	66·2	79	...	...	1·02	5	3·6
Grenada	85·0	26*a*	69·0	sev.	82·0	71·0	...	71	137·0	...	2·49	17	2·5
Toronto	67·2	20	6·0	11	42·4	24·7	23·2	73	118·0	—1·0	2·08	10	4·1
Fredericton	54·0	21	—27·0	8	33·4	7·9	13·5	75	...	...	3·05	7	4·4
St. John, N.B. ...	54·6	31	—8·0	8	32·2	16·2	16·2	71	130·2	—8·6	2·90	12	5·0
Victoria, B.C.	60·0	28	28·0	5	48·4	37·4	35·0	79	122·0	19·5	2·79	17	7·3

a—27.

Johannesburg.—Bright sunshine 157·6 hours.

COLOMBO, CEYLON.—Mean temp. 80°·8, or 0°·5 below, dew point 1·3 below and R 2·36 in. below averages. Mean hourly velocity of wind 3·6 miles. TS on 5 days.

HONGKONG.—Mean temp. 64·0. Bright sunshine 122·1 hours. Mean hourly velocity of wind 13·6 miles.

Melbourne.—Temp. 0°·3 below, and R 2·30 in. above, averages.

Adelaide.—Mean temp. 1·1 in. below, and R ·56 in. below, averages.

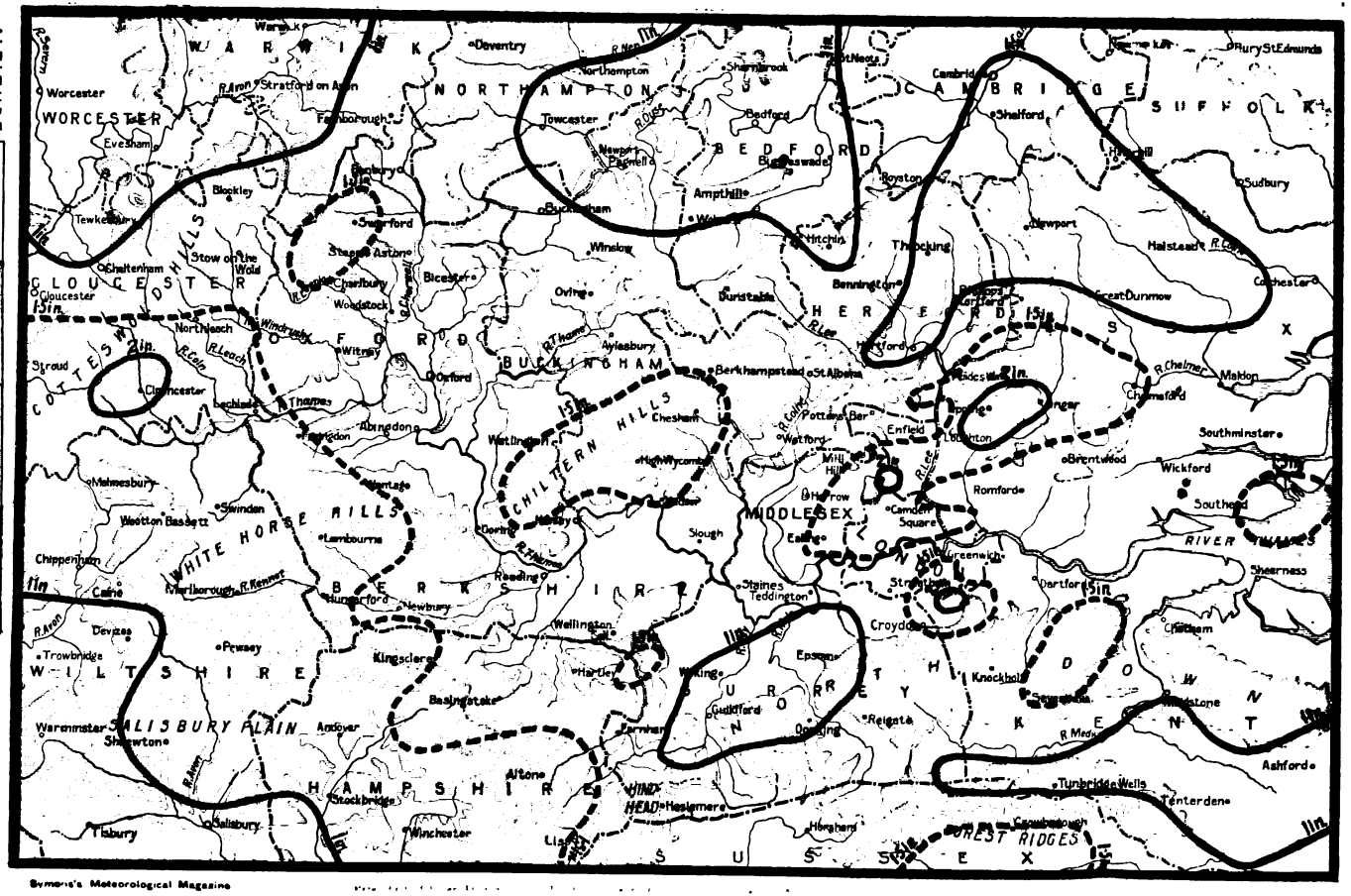
Coolgardie.—Temp. 1·8 in. below, and R slightly above, averages.

Brisbane.—Temp. 3·2 in. below, and R below, averages.

Hobart.—Bright sunshine 167·1 hours.

Wellington.—Mean temp. 0°·4 above, and R ·13 in. above, averages. Bright sunshine, 149·5 hours.

THAMES VALLEY RAINFALL. AUGUST, 1918.



Symons's Meteorological Magazine

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RAINFALL TABLE FOR AUGUST, 1918.

STATION.	COUNTY.	RAINFALL. Aver. 1875—1909. in.	1918. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	Nos. of Day
Camden Square	*London*	2·39	1·78	— ·61	74	·48	2	12
Tenterden	*Kent*	2·42	·94	—1·48	39	·27	2	12
Arundel (Patching)	*Sussex*	2·52	2·22	— ·30	88	·63	2	10
Fordingbridge (Oaklands)	*Hampshire*	2·76	2·91	+ ·15	105	·83	1	13
Oxford (Magdalen College)	*Oxfordshire*	2·44	·99	—1·45	41	·36	25	9
Wellingborough (Swanspool)	*Northampn*	2·36	·71	—1·65	30	·16	25	11
Bury St. Edmunds (Westley)	*Suffolk*	2·52	1·32	—1·20	52	·24	27	12
Geldeston [Beccles]	*Norfolk*	2·22	1·72	— ·50	78	1·15	2	8
Polapit Tamar [Launceston]	*Devon*	3·17	3·29	+ ·12	104	1·00	5	13
Rousdon [Lyme Regis]	,,	2·84	2·30	— ·54	81	·69	1·25	11
Stroud (Field Place)	*Gloucester*	2·90	1·70	—1·20	59	·48	3	9
Church Stretton (Wolstaston)	*Shropshire*	3·43	2·46	— ·97	72	·55	27	14
Boston	*Lincoln*	2·39	1·27	—1·12	53	·34	2	9
Worksop (Hodsock Priory)	*Nottingham*	2·55	1·91	— ·64	75	·62	3	9
Mickleover Manor	*Derbyshire*	2·80	2·97	+ ·17	106	1·23	2	14
Congleton (Buglawton Vic.)	*Cheshire*	3·52	2·90	— ·62	82	·54	2	19
Southport (Hesketh Park)	*Lancashire*	3·73	2·88	— ·85	77	·69	27	12
Wetherby (Ribston Hall)	*York, W.R.*	2·78	2·84	+ ·06	102	·86	4	9
Hull (Pearson Park)	,, *E.R.*	3·05	2·62	— ·43	86	·85	3	12
Newcastle (Town Moor)	*North'land*	3·20	1·58	—1·62	49	·29	25	14
Borrowdale (Seathwaite)	*Cumberland*	11·47	...	...	...	...	...	...
Cardiff (Ely)	*Glamorgan*	4·54	3·61	— ·93	80	1·06	24	17
Haverfordwest	*Pembroke*	4·21	3·15	—1·06	75	·85	1	16
Aberystwyth (Gogerddan)	*Cardigan*	4·88	3·97	— ·91	81	1·02	25	16
Llandudno	*Carnarvon*	3·16	1·57	—1·59	50	·39	25	13
Cargen [Dumfries]	*Kirkcudbrt.*	4·23	6·05	+1·82	143	1·87	25	21
Marchmont House	*Berwick*	3·54	1·81	—1·73	51	·41	27	15
Girvan (Pinmore)	*Ayr*	4·54	5·71	+1·17	126	1·80	26	19
Glasgow (Queen's Park)	*Renfrew*	3·62	2·53	—1·09	70	·46	20	21
Islay (Eallabus)	*Argyll*	4·49	4·39	— ·10	98	·65	11	27
Mull (Quinish)	,,	5·00	5·88	+ ·88	118	·92	22	25
Balquhidder (Stronvar)	*Perth*	6·22	4·20	—2·02	68	1·00	27	22
Dundee (Eastern Necropolis)	*Forfar*	3·34	2·26	—1·08	68	·45	24	19
Braemar	*Aberdeen*	3·63	2·45	—1·18	68	·55	31	16
Aberdeen (Cranford)	,,	3·07	3·50	+ ·43	114	1·25	31	15
Gordon Castle	*Moray*	3·29	3·33	+ ·04	101	...	...	...
Drumnadrochit	*Inverness*	3·11	2·83	— ·28	91	·53	31	20
Fort William	,,	6·15	5·69	— ·46	93	·71	22	25
Loch Torridon (Bendamph)	*Ross*	6·61	9·98	+3·37	151	1·57	31	23
Dunrobin Castle	*Sutherland*	2·71	3·79	+1·08	140	·74	31	17
Glanmire (Lota Lodge)	*Cork*	3·83	2·25	—1·58	59	·99	2	15
Killarney (District Asylum)	*Kerry*	4·57	2·89	—1·68	63	·41	4	21
Waterford (Brook Lodge)	*Waterford*	3·73	3·02	— ·71	81	1·04	1	13
Nenagh (Castle Lough)	*Tipperary*	4·04	4·67	+ ·63	116	1·39	1	22
Ennistymon House	*Clare*	5·01	5·60	+ ·59	112	·97	2	24
Gorey (Courtown House)	*Wexford*	3·31	2·66	— ·65	80	·64	1	12
Abbey Leix (Blandsfort)	*Queen's Co.*	3·94	2·76	—1·18	70	·52	1	16
Dublin (Fitz William Square)	*Dublin*	3·08	2·19	— ·89	71	·60	25	17
Mullingar (Belvedere)	*Westmeath*	4·00	2·32	—1·68	58	·36	26	15
Crossmolina (Enniscoe)	*Mayo*	4·68	4·66	— ·02	100	1·25	5	24
Cong (The Glebe)	,,	4·70	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	4·30	2·78	—1·52	65	·51	26	22
Seaforde	*Down*	3·64	3·61	— ·03	99	1·34	5	15
Ballymena (Harryville)	*Antrim*	4·18	4·69	+ ·51	112	1·57	5	22
Omagh (Edenfel)	*Tyrone*	4·22	3·18	—1·04	75	·45	5	

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SUPPLEMENTARY RAINFALL, AUGUST, 1918.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	1·23	XI.	Lligwy	1·39
,,	Ramsgate.....	·77	,,	Douglas, Isle of Man	2·16
,,	Hailsham	1·55	XII.	Stoneykirk, Ardwell House...	3·54
,,	Totland Bay, Aston House...	1·81	,,	Carsphairn, Shiel.....	6·88
,,	Stockbridge, Ashley..	1·89	,,	Langholm, Drove Road	5·41
,,	Grayshott.....	1·18	XIII.	Selkirk, The Hangingshaw..	1·73
III.	Harrow Weald, Hill House...	1·24	,,	North Berwick Reservoir.....	2·16
,,	Pitsford, Sedgebrook.....	1·56	,,	Edinburgh, Royal Observaty.	1·57
,,	Woburn, Milton Bryant.....	·98	XIV.	Biggar.....	2·00
,,	Chatteris, The Priory.....	1·02	,,	Maybole, Knockdon Farm ...	3·72
IV.	Elsenham, Gaunts End	·92	XV.	Buchlyvie, The Manse.....	3·80
,,	Shoeburyness	1·68	,,	Ardgour House	9·56
,,	Colchester, Hill Ho., Lexden	·86	,,	Oban.....	3·90
,,	Ipswich, Rookwood, Copdock	1·55	,,	Campbeltown, Witchburn ..	...
,,	Aylsham, Rippon Hall.... ..	2·65	,,	Holy Loch, Ardnadam.....	4·82
,,	Swaffham	2·00	,,	Tiree, Cornaigmore	...
V.	Bishops Cannings	2·28	XVI.	Glenquey	4·90
,,	Weymouth.....	1·54	,,	Loch Rannoch Dall.....	2·62
,,	Ashburton, Druid House.....	2·99	,,	Blair Atholl	2·08
,,	Cullompton	3·37	,,	Coupar Angus	3·25
,,	Lynmouth, Rock House	3·23	,,	Montrose, Sunnyside Asylum.	2·32
,,	Okehampton, Oaklands.....	2·97	XVII.	Balmoral	2·00
,,	Hartland Abbey.....	2·32	,,	Fyvie Castle	3·10
,,	St. Austell, Trevarna	2·60	,,	Keith Station	1·63
,,	North Cadbury Rectory.....	3·10	XVIII.	Rothiemurchus	2·33
VI.	Clifton, Stoke Bishop	2·57	,,	Loch Quoich, Loan	20·40
,,	Ledbury, Underdown..... ...	1·55	,,	Skye, Dunvegan	11·39
,,	Shifnal, Hatton Grange.....	1·89	,,	Fortrose.....	2·56
,,	Droitwich.....	·92	,,	Glencarron Lodge	9·31
,,	Blockley, Upton Wold.....	1·26	XIX.	Tongue Manse	5·28
VII.	Grantham, Saltersford.....	1·55	,,	Melvich	4·39
,,	Louth Westgate	1·97	,,	Loch More, Achfary	9·70
,,	Bawtry, Hesley Hall	1·78	XX.	Dunmanway, The Rectory ..	3·01
,,	Whaley Bridge, Mosley Hall	3·43	,,	Mitchelstown Castle.....	3·82
,,	Derby, Midland Railway.....	1·82	,,	Gap of Dunloe Gearahameen	5·00
VIII.	Nantwich, Dorfold Hall	2·75	,,	Darrynane Abbey.....	4·51
,,	Bolton, Queen's Park	4·17	,,	Clonmel, Bruce Villa	2·44
,,	Lancaster, Strathspey	4·04	,,	Broadford, Hurdlestown.....	3·67
IX.	Langsett Moor, Up. Midhope	1·08	XXI.	Enniscorthy, Ballyhyland...	2·80
,,	Scarborough, Scalby	2·82	,,	Rathnew, Clonmannon	1·80
,,	Ingleby Greenhow	2·43	,,	Ballycumber, Moorock Lodge	2·46
,,	Mickleton	...	,,	Balbriggan, Ardgillan	2·23
X.	Bellingham, High Green Manor	2·66	,,	Castle Forbes Gardens.....	2·08
,,	Ilderton, Lilburn Cottage ...	1·19	XXII.	Ballynahinch Castle.....	6·80
,,	Keswick, The Bank.....	5·26	,,	Woodlawn	4·00
XI.	Llanfrechfa Grange	3·57	,,	Westport, St. Helens	2·04
,,	Treherbert, Tyn-y-waun	4·70	,,	Dugort, Slievemore Hotel ...	5·56
,,	Carmarthen, The Friary	3·54	XXIII.	Enniskillen, Portora.....	3·81
,,	Fishguard, Goodwick Station.	3·91	,,	Dartrey [Cootehill]	3·13
,,	Crickhowell, Tal-y-maes.....	2·70	,,	Warrenpoint, Manor House ..	2·43
,,	Gwernargllwydd	2·00	,,	Belfast, Cave Hill Road	3·86
,,	Birmingham WW., Tyrmynydd	2·45	,,	Glenarm Castle	2·53
,,	Lake Vyrnwy	2·49	,,	Londonderry, Creggan Res...	5·25
,,	Llangynhafal, Plas Drâw.....	2·20	,,	Milford, The Manse.....	5·18
,,	Rhwibryfdir	14·99	,,	Killybegs	5·92
,,	Dolgelly, Bryntirion.....	4·03			

Symons's
Meteorological Magazine.

No. 633. OCTOBER, 1918. Vol. LIII.

THE WATER CONTENTS OF THE ATMOSPHERE IN RELATION TO HEAVY RAINFALL.

By W. H. Dines, F.R.S.

The difficulty in this matter is that one must postulate certain wind conditions which may be far from the reality. It is easy to calculate the total amount of water in a column of saturated air obeying the usual law as to decrease of temperature with height and at a given temperature at the bottom, but before the vapour can be extracted all the bottom air must rise, and, of course, that means that fresh air must come in to take its place, and this fresh air hopelessly complicates the matter.

Some time ago the total water contents of the air as recorded by the humidity records of 250 registering balloons were worked up with the following results for England and the Continent :—

In the winter the total equivalent rainfall is about ·40 in., with a range from ·25 in. to ·80 in.; in summer the mean is about ·80 in., with a range from ·50 in. to 1·50 in. The amount seems to depend chiefly on the temperature and but little on anything else, *i.e.*, if the air is warm there is almost certain to be plenty of moisture and conversely. Practically all the water is contained in the first few kilometres.

The total water contents of a column of the atmosphere expressed as rainfall are given in the following table.

It is assumed that the air is just at the saturation point throughout, and that the fall of temperature is 10° F. per kilometre of height. This is about the average rate in the lower strata, and it is only the lower strata that matter. Water vapour at temperatures below 5° F. are neglected.

	°F.			*in.*
Ground temperature	80	..	Total contents	2·86
„ „	70	..	„ „	1·90
„ „	60	..	„ „	1·24
„ „	50	..	„ „	·84
„ „	40	..	„ „	·53
„ „	30	..	„ „	·33
„ „	20	..	„ „	·18

The values used were interpolated from Davis' Elementary Meteorology. A graphical method has been used but the errors should not exceed 5 per cent.

The amount of water entering per day a given area on certain arbitrary assumptions as to the strength and direction and height of the inflowing winds, may be arrived at by the following method. Consider a circular area of 100 kilometres radius. In general it is found that the wind is parallel to the isobars at a height of half a kilometre. Take, therefore, an inflowing wind of 500 metres (1660 ft.) height, with a component velocity of 10 metres per second (22·5 miles per hour), at right angles to the boundary. The amount of air entering per day in cubic metres is equal to $500 \times 2\pi \times 100000 \times 10 \times 24 \times 60 \times 60$. This is the number of cubic centimetres of water entering if each cubic metre contains one gramme. Assume that all this water vapour is condensed.

Rainfall area $= \pi (100000)^2$ square metres.

Average Rainfall (total amount in grammes per square metre) $= \frac{\pi \times 24 \times 6 \times 6 \times 10^{11}}{\pi 10^{10}} = 24 \times 360 = 8640.$

8640 grammes per square metre = 8640 cubic centimetres per 10000 square centimetres = a rainfall of ·864 centimetres, or 8·64 millimetres.

From Davis, graphically, we get the approximate values :—

°F.								
At 80	one	saturated	cubic	metre	contains	25·2	grammes	of water.
,, 70	,,	,,	,,	,,	,,	18·4	,,	,,
,, 60	,,	,,	,,	,,	,,	13·0	,,	,,
,, 50	,,	,,	,,	,,	,,	9·4	,,	,,
,, 40	,,	,,	,,	,,	,,	6·2	,,	,,
,, 30	,,	,,	,,	,,	,,	4·5	,,	,,

Hence the following values :—

	°F.					mm.
Air entering at	80	should give a rainfall of	8·64	×	25·2	= 218
,, ,,	70	,,	,,	,,	,,	159
,, ,,	60	,,	,,	,,	,,	112
,, ,,	50	,,	,,	,,	,,	81
,, ,,	40	,,	,,	,,	,,	54
,, ,,	30	,,	,,	,,	,,	39

On changing to inches :—

At	80°	70°	60°	50°	40°	30° F.
Rainfall	8·58	6·62	4·42	3·20	2·13	1·53 in.

To change to miles instead of kilometres :—

If the radius of the circular area be doubled the amount of the inflowing wind is doubled, but the rainfall area is increased four-fold, therefore the average rainfall is halved. Hence, for an area of 100 miles radius instead of 100 kilometres, the rainfall must be reduced by 5/8, and taking 10 miles per hour instead of 10 metres per second it must be further reduced by multiplying by 10/22·5.

At.....	80°	70°	60°	50°	40°	30°
Rainfall ..	2·40	1·84	1·23	·89	·59	·43 in.

If the air entering the area at 80° F. left it at 60° F., the rainfall would be 2·40—1·23, and so on for entering and leaving at other temperatures.

The circle gives the minimum rainfall because it contains the largest area of any figure in the smallest perimeter; for an oval the rainfall would be greater. Also the rainfall is the average over the whole area, in reality it would be concentrated into parts of the area.

In the above remarks it is assumed that all rain is due to dynamic cooling. All heavy rain is certainly so caused. The supposition that the water-bringing winds enter a rainy area from all sides is probably far from the truth, but the figures show that very heavy rainfalls must be due to inflowing winds, for the air over any given area at any time does not contain water enough to produce them.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

WATERSPOUT CLOUD EFFECT.

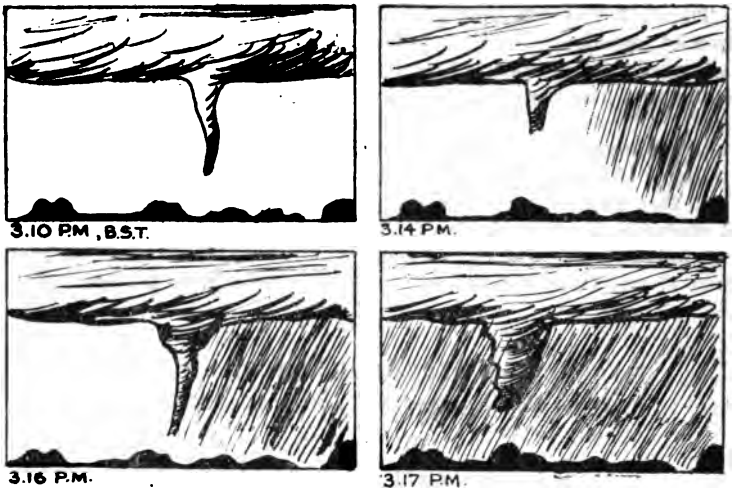
At Northampton, one August day, I witnessed the terrestrial equivalent of a waterspout.

At 3.10 p.m., looking northwards, I noticed a clearly defined slate grey funnel-shaped suspension from the rear and lowest portion of the base of a large, irregularly constructed Nimbo-cumulus, which spread slowly southwards precipitating rain accompanied by thunder and leaving as an aftermath an extensive and dense upper canopy of cloud from which rain continued to fall for two hours at Northampton. Eye-witnesses in the immediate neighbourhood of the phenomenon have described it as resembling a balloon and refer to the swaying motion of the funnel, but I have been unable to acquire any positive information regarding violent wind effects or so-called cloud-bursts.

At 3.14 the funnel diminished considerably in size, but by 3.16 had rapidly revived in a slightly different form only to disintegrate and disappear a minute later within a dense rain curtain which spread from right to left coinciding with the occurrence of the first thunder heard by me. The mass of scud forming the rear limit of the low-hanging base reached my zenith at 3.50 and was obviously in a state of the greatest agitation.

Of rain only a few drops, and these of exceptionally large size, reached earth at this time, but steady rain followed from the upper canopy and continued for two hours. Fitful south-westerly and

north-westerly gusts were also noted at this period, but with this exception only very light and variable breezes from the west were experienced before, during and after the storm. The sky gradually cleared during the evening.



I was enabled to get into touch with witnesses through the medium of the respective rectors of the parishes north of Northampton to whom I am very grateful for their help. The complete concordance of descriptions is as satisfactory as unusual, but what is remarkable and not without significance is the fact that, of the crowds of people out-of-doors on a Saturday afternoon in a large town, so very few appear to have noticed what is surely a most unusual spectacle.

Additional facts justify the following conclusions :—

Origin :—Its brief existence seems to have begun and ended within the basin of one of the tributaries of the river Nene.

Dimensions :—Its diameter was about 700 feet at the top of the funnel diminishing to, say, 150 feet for the greater part of its length. The base of the cloud from which the funnel was suspended was about 3,000 feet above the ground, and the length of the spout rather more than 2,000 feet.

Speed :—The spout took 7 minutes to travel half a mile and the cloud base of scud referred to, or, perhaps more properly, the process of which the agitated scud was merely the visible sign, would appear to have travelled at the same slow rate. One witness states that it had an anti-clockwise motion and " . . . . it burst and simply drenched us in a moment."

A. S. MARTIN-SMITH, Lieut.

71, Wood Street, Barnet, Herts, August 19th, 1918

THE GREEN FLASH.

MR. COBBOLD'S note in this month's *Meteorological Magazine*, p. 90, of his observation on February 15th, 1906, was no doubt induced by my notes in last year's volume at p. 100. May I be allowed space to call attention to the fact that what Mr. Cobbold, like many other Observers in the *Meteorological Magazine* of 1905 and 1906, describes as a green "flash" is in fact a change in the apparent colour of a small sector of the sun during an appreciable, though short space of time, and is not really to be defined as a flash. What I, and I think a few other Observers, have described was a ray or rays of light of green colour darting out from the sun's limb at its disappearance, and quite momentary, and so a true flash.

If we are to arrive at a satisfactory explanation, we must carefully distinguish the two phenomena. JAMES G. WOOD.

115, Sutherland Avenue, W. 9, October 6th, 1918.

MR. PAUL COBBOLD appears, from his letter published in your last Magazine, to be puzzled that, when a larger portion of the sun's disc appeared above the horizon, the "Green Flash" disappeared, seen when only a small portion of the sun was visible.

Is it not likely that this was owing to the :—

(i.) Stronger light of the sun, or

(ii.) To a difference in the density of the smoke.

Anyone who can remember the autumn of the Krakatoa eruption will recall the unanswered questionings which arose about the marvellous atmospheric effects—green suns, blue moons and gorgeous sunsets, till the startling news of the eruption came to hand, and we learnt that the air was full of volcanic dust.

In a similar way was not smoke capable of changing the light, in the case referred to by Mr. Cobbold ?

ONE WHO SAW THE EFFECTS OF THE

September 17th, 1918. KRAKATOA ERUPTION.

[We agree with the correspondent whose letter is given above that the green colour given to the disc of the sun when seen through a veil of smoke is akin to the Krakatoa phenomena. The subject of the green suns of thirty-five years ago was very fully dealt with by Mr. C. Michie Smith, of Madras. The phenomenon, as Mr. Wood points out, is different altogether from the momentary green rays seen at sunset and sunrise.—ED. *S.M.M.*]

OUR RAINFALL TABLES.

WE regret that the difficulty referred to last month has again prevented the publication of our rainfall tables. We propose, however, to print these and to circulate them to our readers at some future time.

THE WORK OF THE METEOROLOGICAL OFFICE.

We have just received the thirteenth annual report of the Meteorological Committee for the year ended 31st March, 1918 (Cd. 9143, price 2d.), and the special circumstances of the time make it appropriate to refer to it at some length. Our readers include the great majority of those who, before the war, were in the habit of looking forward to the appearance of the daily, weekly, monthly, annual and occasional publications of the Meteorological Office and of utilizing their contents for scientific or economic purposes. The evils of war are brought home very keenly to those loyal and patriotic citizens by such restrictions on liberty as the suppression of the publications of the Meteorological Office. The fact that some of these publications if issued promptly might conceivably be useful to the enemy if conveyed to him only makes the honest patriot suffer the more from the indignity of being treated as a potential traitor to his country. Added to that, as he does not know who is responsible for the restriction, he is apt to be haunted by the fear that the veil of mystery may serve as a screen for departmental inefficiency and the doubt whether the activities he followed with such interest in time of peace may have been slackened or stopped.

If such vain fears have found a place in any reader's mind the relief which the Annual Report affords must be as complete as it is welcome, for it shows that far from being slackened the activities of the Meteorological Office have been greatly stimulated, the volume of its work increased and its usefulness carried into new spheres. The Report does not, of course, refer to the changes announced in our issue for June last, which belong to the present official year. As for 1917-18 the Report says :—

"The most noteworthy feature of the year is the great development of pressing demands for expert meteorological assistance, and the prospect of still larger demands in the future, as regards the Naval, Military and Air Services. The Committee have to note the establishment of a Naval Meteorological Service under a director attached to the Hydrographic Office, a large extension of the Meteorological Section, R.E., various projects in connection with the Royal Flying Corps arranged in conjunction with the Office by Major G. I. Taylor, R.A.F., and the prospect of a large meteorological organization in connection with the Royal Air Force."

Some particulars are given of the development of the Meteorological Section of the Royal Engineers under the charge of Colonel Lyons. In this connection it is noted that a Home Unit has been established "to meet the requirements of a number of military services," with headquarters on Salisbury Plain, under the charge of Captain C. J. P. Cave. The selection of men for this Unit and their training are undertaken at the Meteorological Office.

The Forecast Division has been re-organized to meet a greatly increased demand for forecasts, of course, for military and naval purposes only, and continuous attendance at the Office for this purpose has been introduced.

The Meteorological Office has also taken into its system the Committee on Atmospheric Pollution. All the increased work in every department is, of course, hampered by the difficulty of securing a sufficient staff, and this necessarily falls more heavily on the old essential duties of the Office than on the new departures which are largely under military conditions.

The most interesting thing by far in the Report before us is the indication of future developments given in the following terms :—

" It is obvious that there must be distributing centres in charge of competent meteorologists in various centres as well as London, whether they be under the control of the Meteorological Committee or not. And as the various Dominions beyond the seas will themselves require some provision for compiling and utilising meteorological information some co-operative organisation is called for on the part of the Imperial Government in conjunction with the Local Governments. This wide extension of its outlook which must be faced if the Office is to continue to be the central national and imperial establishment for meteorology has been before the Committee on several occasions, in the first place with reference to the development of the organisation within the Office to meet the increased requirements for information of different kinds ; and, secondly, with reference to application for the acceleration of the supply of information in distant parts of the Kingdom, which can only be satisfied by local centres of distribution.

" In response to a request from the Ministry of Reconstruction for a report on the steps taken by the Committee with reference to post-war problems a memorandum was prepared and submitted setting out the peculiarities of the British meteorological services depending upon the history of the development of meteorological work in this Country and the organization necessary for completing the service. It was pointed out that as the work of the Office originated in the study of the meteorology of the sea exclusively, the detailed study of rainfall which is obviously a vital part of general meteorology and which is the fundamental study of practically all national meteorological establishments in the Dominions and in foreign countries, is still in this Country, in accordance with traditions, left in charge of a private organization, and also that the municipal authorities in this Country make no provision as a general rule for recording their experiences of the weather for the guidance of their successors ; thus all the information required for climatological questions to supplement what appears in the Daily Weather Report is left almost exclusively to

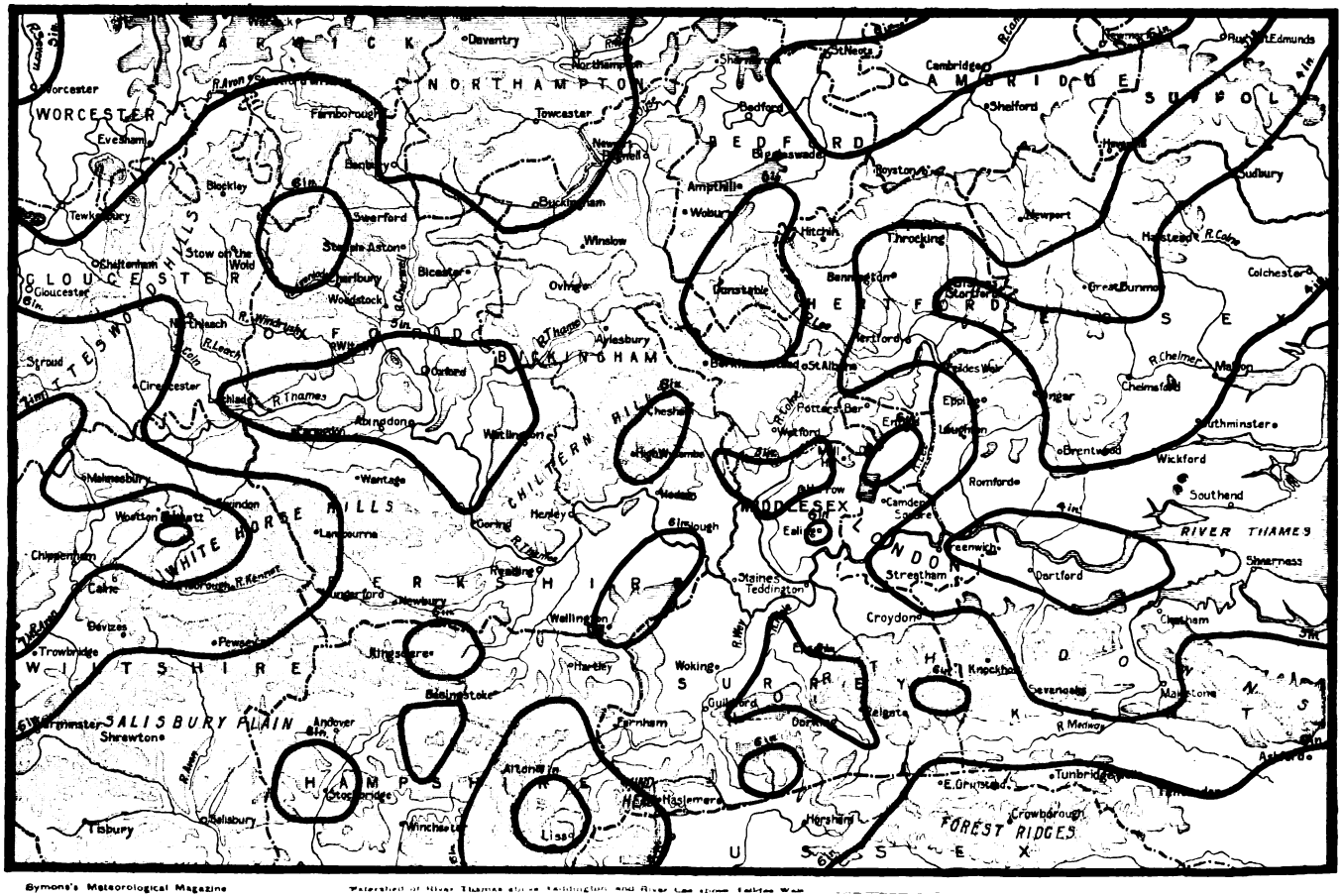
private effort. Now that the weather is recognised to be of primary importance in so many affairs of life and the requirements of so many departments of the Navy, the Army and the Air Force include a knowledge of weather conditions, not only at the surface in the various parts of the globe but at elevations which have up to now been of interest to the meteorologist alone, some more comprehensive organisation is necessary.

"And it is felt that the steps towards this organization cannot be postponed until after the war. While on the one hand the war makes the development of the organization difficult on account of the difficulty of obtaining staff and materials for observatories and experimental work, yet, on the other hand, the war has shown the special importance of certain meteorological problems the solution of which cannot await the conclusion of hostilities."

We have long felt that the British Rainfall Organization, to which reference is made in the foregoing quotation, was fulfilling a duty of national importance which in all other countries has been undertaken by the Government. We believe that the courageous enterprise of Mr. G. J. Symons has established the rainfall observations in this country on a wider basis than has been accomplished by any State system in the world. The time is long past when the responsibility for the abandonment of rainfall research in this country to private enterprise could profitably be discussed. and we are happy to think that the passage we have quoted implies that the Government is no longer bound by the old tradition of with-holding recognition from the work which was a fresh outcast from official favour in the days before "Symons's Monthly Rain Circular" developed into "Symons's Meteorological Magazine." We should be glad to think that the time is ripe for the participation of the Rainfall Organization in a wider scheme of national meteorological organizations which should encourage local associations for the collection of data for headquarters as well as the dissemination of data from headquarters. For many years to come the shock of the war will continue to embarrass private enterprise and to throw in an increased degree upon the State the duty of sustaining those useful activities which in unbroken peace could safely be left to the more natural process of spontaneous development. Whether this be so or not we are very sure that the great body of voluntary rainfall Observers will continue to serve their country by collecting the information the enormous value of which is still far too little recognized by the public as a whole.

ERRATUM—Page 79, Table VII, Col. 2, January—*for* 8·8 *read* 0·S.

THAMES VALLEY RAINFALL SEPTEMBER, 1918.


ALTITUDE SCALE
Below 250 feet
250 to 500 feet
500 to 1000 feet
Above 1000 feet
SCALE OF MILES
0 5 10 15 20
WORCESTER
GLOUCESTER
WILTSHIRE
BERKSHIRE
OXFORDSHIRE
BUCKINGHAM
BEDFORD
NORTHAMPTON
WARWICK
HERTFORD
MIDDLESEX
LONDON
SURREY
HAMPSHIRE
SUSSEX
KENT
ESSEX
CAMBRIDGE
SUFFOLK
COTSWOLD HILLS
CHILTERN HILLS
WHITE HORSE HILLS
SALISBURY PLAIN
FOREST RIDGES
RIVER THAMES
Worcester
Evesham
Tewkesbury
Cheltenham
Gloucester
Stroud
Cirencester
Malmesbury
Wantage
Abingdon
Oxford
Chipping Norton
Banbury
Bicester
Buckingham
Aylesbury
Wendover
Tring
Dunstable
Luton
Bedford
Wellingborough
Northampton
Towcester
Daventry
Rugby
Leamington
Stratford-on-Avon
Evesham
Pershore
Tewkesbury
Cheltenham
Stow-on-the-Wold
Moreton-in-Marsh
Chipping Norton
Woodstock
Witney
Faringdon
Lambourn
Newbury
Reading
Wokingham
Maidenhead
Slough
Windsor
Staines
Egham
Chertsey
Weybridge
Guildford
Godalming
Haslemere
Petersfield
Midhurst
Horsham
Dorking
Reigate
Redhill
Oxted
Edenbridge
Tonbridge
Sevenoaks
Maidstone
Ashford
Canterbury
Dover
Folkestone
Hythe
Romney
Rye
Hastings
Battle
Eastbourne
Lewes
Brighton
Worthing
Chichester
Arundel
Bognor
Portsmouth
Southsea
Fareham
Gosport
Alton
Farnham
Aldershot
Basingstoke
Andover
Whitchurch
Winchester
Stockbridge
Romsey
Salisbury
Shrewton
Amesbury
Tisbury
Warminster
Frome
Shepton Mallet
Wells
Glastonbury
Bridgwater
Taunton
Chard
Crewkerne
Yeovil
Sherborne
Dorchester
Weymouth
Bridport
Lyme Regis
Axminster
Honiton
Exeter
Tiverton
Barnstaple
Ilfracombe
Bideford
Torrington
Okehampton
Launceston
Bodmin
Wadebridge
Camelford
Padstow
Newquay
St. Ives
Penzance
Helston
Falmouth
Truro
Redruth
Camborne
St. Austell
Fowey
Looe
Liskeard
Saltash
Plymouth
Tavistock
Ivybridge
Totnes
Dartmouth
Kingsbridge
Salcombe
Brixham
Torquay
Newton Abbot
Teignmouth
Dawlish
Exmouth
Sidmouth
Axminster
Lyme Regis
Bridport
Dorchester
Weymouth
Swanage
Wareham
Poole
Bournemouth
Christchurch
Lymington
Ringwood
Fordingbridge
Romsey
Southampton
Eastleigh
Winchester
Alresford
Petersfield
Liphook
Haslemere
Godalming
Guildford
Woking
Chertsey
Staines
Windsor
Slough
Maidenhead
Henley
Wallingford
Abingdon
Oxford
Witney
Burford
Chipping Norton
Moreton-in-Marsh
Stow-on-the-Wold
Bourton-on-the-Water
Cirencester
Tetbury
Malmesbury
Chippenham
Calne
Devizes
Marlborough
Hungerford
Newbury
Thatcham
Reading
Wokingham
Bracknell
Ascot
Windsor
Staines
Egham
Chertsey
Weybridge
Esher
Kingston
Richmond
Twickenham
Hounslow
Ealing
Acton
Willesden
Hampstead
Highgate
Finchley
Barnet
Edgware
Harrow
Wembley
Hendon
Golders Green
Hampstead
Highgate
Tottenham
Edmonton
Enfield
Waltham Cross
Cheshunt
Hoddesdon
Ware
Hertford
Bishop's Stortford
Harlow
Epping
Chigwell
Romford
Hornchurch
Upminster
Brentwood
Ingatestone
Billericay
Wickford
Rayleigh
Southend
Leigh
Canvey Island
Benfleet
Tilbury
Gravesend
Dartford
Erith
Woolwich
Greenwich
Deptford
Lewisham
Streatham
Croydon
Beckenham
Bromley
Orpington
Sevenoaks
Tonbridge
Tunbridge Wells
Crowborough
Uckfield
Lewes
Newhaven
Seaford
Eastbourne
Hailsham
Battle
Hastings
Rye
Winchelsea
Romney
Hythe
Folkestone
Dover
Deal
Sandwich
Ramsgate
Margate
Broadstairs
Canterbury
Whitstable
Faversham
Sittingbourne
Chatham
Rochester
Gillingham
Sheerness
Queenborough
Maidstone
Ashford
Tenterden
Cranbrook
Hawkhurst
Battle
Bexhill

THE RAINFALL OF SEPTEMBER, 1918.

For many years past most parts of the British Isles have experienced a succession of comparatively dry Septembers and for the country as a whole it is certainly necessary to go back as far as 1896 for any parallel to the abnormal wetness of the month just completed. The table of rainfall on page 104 shows that the rainfall of the month was in excess of the average at every station quoted, representing all parts of the British Isles, and that it was double the average or more at 85 out of the 54 stations, including practically all those in England and Wales. The greatest excess occurred in England, particularly in the centre and south; more than three times the average fell at three stations in the north Midlands. More than twice the average also fell in most parts of Ireland, the total reaching 289 per cent. of the average at Courtown, in Co. Wexford. Scotland was relatively the least rainy of the countries, but more than twice the average fell in the south. The smallest percentage excess was 8 per cent. in Mull.

Parts of the east of Great Britain had rather less than 4 inches of rain during the month, but more than 6 inches fell over a number of isolated areas in the south-east, the largest of which extended from Chichester nearly to Canterbury. One or two stations in these areas had as much as 7 inches, but in no case did the rainfall reach the amounts recorded in the same district in September, 1896, when a considerable part of the south-eastern counties had more than 9 inches and some stations more than 10 inches. At Camden Square, however, the total fall of 5·68 in. was the largest recorded in September in 61 years' observations, exceeding that in 1896 by ·17 in. The duration of rainfall was 72·8 hours, or 47·4 hours above the average.

In September, 1918, more than 6 inches fell also over the whole of the western portion of Great Britain, save the Cheshire Plain and part of the North Wales coast. The whole of the interior of Wales, almost the whole of the Pennines, and parts of Dartmoor and Exmoor, had more than 10 inches, the total rising to more than 20 inches in the centre of the Lake District and to 30 inches on Snowdon. The West Highlands were not so wet, having more than 8 inches over the district generally and as much as 10 inches only in isolated patches. The total was less than 2 inches at one or two points on the east coast. The fall in Ireland exceeded 6 inches except in the centre and east and was less than 5 inches only on a narrow strip of the east coast, but the amounts recorded in the west were more moderate than was the case in England and Wales, and more than 10 inches was, as in Scotland, very local.

Taking the countries as a whole the general rainfall expressed as a percentage of the average was as follows:—England and Wales, 247 per cent.; Scotland, 150 per cent.; Ireland, 209 per cent.; British Isles, 207 per cent.

PUBLICATION POSTPONED BY ORDER OF CHIEF CENSOR, ADMIRALTY.

RAINFALL TABLE FOR SEPTEMBER, 1918.

STATION.	COUNTY.	RAINFALL. Aver. 1875–1909. in.	1918. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Date.	Nos. of Day
Camden Square	*London*	2·00	5·68	+3·68	284	1·23	29	23
Tenterden	*Kent*	2·25	6·26	+4·01	278	1·45	29	21
Arundel (Patching)	*Sussex*	2·58	7·46	+4·88	289	1·40	29	21
Fordingbridge (Oaklands)	*Hampshire*	2·39	5·70	+3·31	239	1·19	29	26
Oxford (Magdalen College)	*Oxfordshire*	1·98	4·58	+2·60	230	1·13	29	24
Wellingborough (Swanspool)	*Northampn*	2·13	4·77	+2·64	225	1·17	29	24
Bury St. Edmunds (Westley)	*Suffolk*	2·18	5·88	+3·70	270	1·27	29	25
Geldeston [Beccles]	*Norfolk*	2·13	3·73	+1·60	176	1·37	29	23
Polapit Tamar [Launceston]	*Devon*	3·11	8·40	+5·29	270	1·31	29	27
Rousdon [Lyme Regis]	,,	2·69	6·29	+3·60	235	1·40	29	27
Stroud (Field Place)	*Gloucester*	2·39	6·40	+4·01	268	1·26	30	24
Church Stretton (Wolstaston)	*Shropshire*	2·40	7·34	+4·94	306	·86	4	30
Boston	*Lincoln*	2·07	4·21	+2·14	204	·71	4	23
Worksop (Hodsock Priory)	*Nottingham*	1·84	4·26	+2·42	231	·61	15	26
Mickleover Manor	*Derbyshire*	2·11	6·35	+4·24	301	·84	4	25
Congleton (Buglawton Vic.)	*Cheshire*	2·67	5·62	+2·95	211	·55	1	30
Southport (Hesketh Park)	*Lancashire*	3·09	8·49	+5·40	274	1·35	15	29
Wetherby (Ribston Hall)	*York, W.R.*	2·11	6·95	+4·84	329	1·00	15	24
Hull (Pearson Park)	,, *E.R.*	2·05	4·14	+2·09	202	·70	15	26
Newcastle (Town Moor)	*North'land*	2·00	5·30	+3·30	265	1·48	15	25
Borrowdale (Seathwaite)	*Cumberland*	11·28	22·25	+10·97	197	...	...	...
Cardiff (Ely)	*Glamorgan*	3·61	10·69	+7·08	296	1·09	18	29
Haverfordwest	*Pembroke*	3·91	8·25	+4·34	211	1·21	29	28
Aberystwyth (Gogerddan)	*Cardigan*	3·89	9·90	+6·01	255	1·21	3	29
Llandudno	*Carnarvon*	2·50	6·95	+4·45	279	1·35	15	27
Cargen [Dumfries]	*Kirkcudbrt.*	3·34	7·29	+3·95	218	2·34	15	21
Marchmont House	*Berwick*	2·67	5·72	+3·05	214	1·86	15	20
Girvan (Pinmore)	*Ayr*	4·30	5·65	+1·35	131	·78	16	25
Glasgow (Queen's Park)	*Renfrew*	2·99	6·32	+3·33	211	1·16	17	22
Islay (Eallabus)	*Argyll*	4·49	7·51	+3·02	167	1·31	9	24
Mull (Quinish)	,,	5·20	5·61	+ ·41	108	1·12	7	22
Balquhidder (Stronvar)	*Perth*	5·81	8·03	+2·22	138	1·60	19	23
Dundee (Eastern Necropolis)	*Forfar*	2·34	3·85	+1·51	164	·91	15	16
Braemar	*Aberdeen*	2·73	4·54	+1·81	166	·75	15	23
Aberdeen (Cranford)	,,	2·69	4·42	+1·73	164	·77	10, 15	20
Gordon Castle	*Moray*	2·58	4·66	+2·08	181	...	...	...
Drumnadrochit	*Inverness*	2·94	4·70	+1·76	160	·50	7	25
Fort William	,,	6·66	7·88	+1·22	119	1·32	22	23
Loch Torridon (Bendamph)	*Ross*	7·28	9·39	+2·11	129	·95	7	23
Dunrobin Castle	*Sutherland*	2·51	3·45	+ ·94	137	·55	16	17
Glanmire (Lota Lodge)	*Cork*	3·20	6·63	+3·43	207	1·20	15	23
Killarney (District Asylum)	*Kerry*	3·79	7·59	+3·80	200	·82	16	30
Waterford (Brook Lodge)	*Waterford*	3·19	7·97	+4 78	250	1·44	3	25
Nenagh (Castle Lough)	*Tipperary*	3·16	7·37	+4·21	233	1·04	21	23
Ennistymon House	*Clare*	4·22	8·20	+3·98	194	1·22	21	27
Gorey (Courtown House)	*Wexford*	2·78	8·01	+5·23	289	1·41	15	23
Abbey Leix (Blandsfort)	*Queen's Co.*	2·93	5·47	+2·54	187	·78	15	24
Dublin (Fitz William Square)	*Dublin*	2·06	4·87	+2·81	236	1·26	15	26
Mullingar (Belvedere)	*Westmeath*	3·02	5·52	+2·50	183	·97	15	22
Crossmolina (Enniscoe)	*Mayo*	4·42	7·83	+3·41	178	·98	15	26
Cong (The Glebe)	,,	4·05	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	3·65	8·24	+4·59	226	1·21	16	27
Seaforde	*Down*	3·25	5·05	+1·80	155	1·72	15	27
Ballymena (Harryville)	*Antrim*	3·43	7·17	+3·74	209	1·70	15	26
Omagh (Edenfel)	*Tyrone*	3·39	7·18	+3·79	211	1·10	15	27

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SUPPLEMENTARY RAINFALL, SEPTEMBER, 1918.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	5·69	XI.	Lligwy	7·29
,,	Ramsgate	4·29	,,	Douglas, Isle of Man	9·64
,,	Hailsham	6·77	XII.	Stoneykirk, Ardwell House...	5·92
,,	Totland Bay, Aston House...	5·05	,,	Carsphairn, Shiel	10·63
,,	Stockbridge, Ashley..	5·17	,,	Langholm, Drove Road	8·81
,,	Grayshott	6·23	XIII.	Selkirk, The Hangingshaw..	6·28
III.	Harrow Weald, Hill House...	4·84	,,	North Berwick Reservoir	4·69
,,	Pitsford, Sedgebrook	4·06	,,	Edinburgh, Royal Observaty.	4·40
,,	Woburn, Milton Bryant	4·92	XIV.	Biggar	4·78
,,	Chatteris, The Priory	5·37	,,	Maybole, Knockdon Farm ...	6·49
IV.	Elsenham, Gaunts End	4·61	XV.	Buchlyvie, The Manse	6·65
,,	Shoeburyness	4·33	,,	Ardgour House	9·29
,,	Colchester, Hill Ho., Lexden	3·66	,,	Oban	5·49
,,	Ipswich, Rookwood, Copdock	3·92	,,	Campbeltown, Witchburn ..	...
,,	Aylsham, Rippon Hall	4·94	,,	Holy Loch, Ardnadam	8·73
,,	Swaffham	5·41	,,	Tiree, Cornaigmore	...
V.	Bishops Cannings	6·10	XVI.	Glenquey	6·80
,,	Weymouth	5·77	,,	Loch Rannoch Dall	5·85
,,	Ashburton, Druid House	10·92	,,	Blair Atholl	3·92
,,	Cullompton	7·46	,,	Coupar Angus	3·34
,,	Lynmouth, Rock House	9·81	,,	Montrose, Sunnyside Asylum.	2·72
,,	Okehampton, Oaklands	9·10	XVII.	Balmoral	4·59
,,	Hartland Abbey	7·41	,,	Fyvie Castle	4·91
,,	St. Austell, Trevarna	7·95	,,	Keith Station ..	7·34
,,	North Cadbury Rectory	5·00	XVIII.	Rothiemurchus	4·43
VI.	Clifton, Stoke Bishop	10·61	,,	Loch Quoich, Loan	18·25
,,	Ledbury, Underdown	5·37	,,	Skye, Dunvegan	9·03
,,	Shifnal, Hatton Grange	5·26	,,	Fortrose	3·15
,,	Droitwich	4·98	,,	Glencarron Lodge	9.55
,,	Blockley, Upton Wold	5·64	XIX.	Tongue Manse	4·91
VII.	Grantham, Saltersford	3·72	,,	Melvich	4·18
,,	Louth Westgate	4·31	,,	Loch More, Achfary	8·99
,,	Bawtry, Hesley Hall	4·63	XX.	Dunmanway, The Rectory ..	9·31
,,	Whaley Bridge, Mosley Hall	9·35	,,	Mitchelstown Castle	7·03
,,	Derby, Midland Railway	5·35	,,	Gap of Dunloe Gearahameen	12·90
VIII.	Nantwich, Dorfold Hall	5·78	,,	Darrynane Abbey	7·86
,,	Bolton, Queen's Park	12·71	,,	Clonmel, Bruce Villa	7·18
,,	Lancaster, Strathspey	10·49	,,	Broadford, Hurdlestown	8·12
IX.	Langsett Moor, Up. Midhope	8·87	XXI.	Enniscorthy, Ballyhyland...	8·33
,,	Scarborough, Scalby	6·41	,,	Rathnew, Clonmannon	5·68
,,	Ingleby Greenhow	5·13	,,	Ballycumber, Moorock Lodge	5·33
,,	Mickleton	7·90	,,	Balbriggan, Ardgillan	4·91
X.	Bellingham, High Green Manor	5·84	,,	Castle Forbes Gardens	6·11
,,	Ilderton, Lilburn Cottage ...	5·39	XXII.	Ballynahinch Castle	7·55
,,	Keswick, The Bank	13·67	,,	Woodlawn	6·56
XI.	Llanfrechfa Grange	10·06	,,	Westport, St. Helens	4·70
,,	Treherbert, Tyn-y-waun	17·64	,,	Dugort, Slievemore Hotel ...	7·95
,,	Carmarthen, The Friary	9·76	XXIII.	Enniskillen, Portora	5·73
,,	Fishguard, Goodwick Station.	7·98	,,	Dartrey [Cootehill]	5·84
,,	Crickhowell, Tal-y-maes	8·00	,,	Warrenpoint, Manor House ..	4·28
,,	Gwernargllwydd	4·00	,,	Belfast, Cave Hill Road	5·72
,,	Birmingham WW., Tyrmynydd	11·64	,,	Glenarm Castle	7·97
,,	Lake Vyrnwy	13·88	,,	Londonderry, Creggan Res...	6·80
,,	Llangynhafal, Plas Drâw	5·35	,,	Milford, The Manse	7·36
,,	Rhwibryfdir	28·32	,,	Killybegs	9·80
,,	Dolgelly, Bryntirion	14·72			

Climatological Table for the British Empire, April, 1918.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	69·4	25	31·4	19	53·4	38·0	...	87	114·6	24·9	3·24	20	8·7
Malta	71·8	20	52·0	10	64·7	55·9	...	81	129·0	42·5	·30	3	2·5
Lagos	90·3	12	70·2	5	88·2	75·3	74·1	74	150·4	68·0	4·15	10	7·5
Cape Town	97·4	5	43·0	10	76·6	53·3	52·3	65	...	...	1·03	6	3·7
Johannesburg	77·0	11	37·4	2	70·7	48·4	44·0	65	...	37·0	...	...	2·7
Mauritius	84·9	6	65·8	24	80·8	70·7	68·2	79	...	60·8	7·30	20	7·0
Bloemfontein	79·8	12	36·6	20	74·2	45·2	44·3	56	..	...	·01	1	2·2
Calcutta...	101·2	6	66·8	19	94·4	74·0	69·6	67	...	58·0	4·73	2	2·7
Madras	99·2	27	68·5	1	93·3	76·2	75·0	78	158·4	64·6	·00	0	1·7
Colombo, Ceylon ...	92·6	9	71·4	30	89·4	74·8	73·1	79	157·2	66·8	4·53	9	4·7
Hongkong	84·0	29	58·5	13	75·0	67·0	65·8	84	...	...	4·44	12	6·7
Sydney	83·6	4	51·4	30	71·3	56·1	56·9	80	132·0	46·5	4·71	24	5·4
Melbourne	76·4	11	40·6	21	66·0	51·0	49·2	71	127·9	30·4	1·61	15	6·4
Adelaide	83·4	12	45·7	17	72·1	54·8	50·1	61	144·0	35·5	·88	10	5·1
Perth	92·4	18	54·3	11	77·2	61·3	58·9	72	151·4	45·3	2·25	8	6·4
Coolgardie	88·0	18	45·0	24	75·7	56·4	52·0	61	152·0	42·4	3·56	10	5·3
Brisbane	86·2	6	53·7	29	76·5	58·7	58·1	72	146·4	49·1	1·70	10	4·2
Hobart, Tasmania ..	68·1	12	40·1	22	59·9	46·9	43·2	68	124·2	32·3	1·99	15	6·6
Wellington ...	61·4	7	48·9	26	52·9	58·2	51·4	78	145·0	29·1	3·53	16	6·9
Jamaica, Kingston ..	88·4	7	67·4	1	86·1	70·4	69·0	79	...	...	3·16	7	4·0
Grenada	86·0	2, 27	69·0	25	84·0	72·0	...	71	138·0	...	1·60	10	4·5
Toronto	69·0	15	22·7	19	53·0	34·3	28·8	64	121·2	19·0	1·41	10	5·2
Fredericton	71·0	28	18·0	*a*	52·7	27·5	27·3	57	...	...	2·73	4	4·1
St. John, N.B. ...	60·5	29	18·7	18	48·2	30·1	28·6	68	121·2	18·5	2·57	9	4·4
Victoria, B.C.	69·8	21	33·0	1	56·3	41·3	38·0	67	126·8	23·0	·35	5	3·8

a—3, 8, 12..

Johannesburg.—Bright sunshine 289·4 hours.

COLOMBO, CEYLON.—Mean temp. 82°·2, or 0°·4 below, dew point 1·5 below and R 2·65 in. below averages. Mean hourly velocity of wind 4·0 miles.

HONGKONG.—Mean temp. 70·4. Bright sunshine 158·6 hours. Mean hourly velocity of wind 10·6 miles.

Melbourne.—Temp. 1·0° below, and R ·67 in. below, averages.

Adelaide.—Mean temp. 0·6 in. below, and R ·97 in. below, averages.

Perth.—Cyclonic gale on 21st. Wind velocity 61 miles an hour

Coolgardie.—Temp. 0·9 in. above, and R nearly three inches above, average.

Brisbane.—Temp. 3°·3 below, and R 1·93 in. below, averages.

Hobart.—Mean temp. 1·7 in. below, and R 0·9 in. above, averages.

Wellington.—Mean temp. 0°·8 above, and R ·46 in. below, averages. Bright sunshine, 127·1 hours.

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WORK AND WATER POWER.

By Hugh Robert Mill.

The force of gravity is the potent agent in doing several kinds of work. These examples will make this plain :—

(1.)—A glass bottle may be smashed into little pieces by means of a small hammer and any one who does so is conscious of doing quite a heavy piece of work, and the smaller the fragments into which the bottle is reduced the heavier is the work required in wielding the hammer. But if a bottle is placed on a first-floor window sill no appreciable work is required to push it over, and when it falls on the pavement below it will be smashed in pieces. If a bottle is similarly released from a second floor window the pieces into which it is smashed will be smaller ; and if from a third floor window smaller still. Hence it is obvious that the greater the height from which the bottle drops the smaller are the fragments into which it is broken, in other words, the greater is the amount of work expended in smashing it. This work was done by gravity bringing the bottle and the ground together ; but gravity is powerless to produce this effect unless the bottle and the ground were originally apart ; and this was effected by the person who did the work of carrying the bottle from the ground to the upper window. The more work done in raising the bottle above the ground, the more work was the weight of the bottle able to do when the bottle reached the ground by falling freely.

This is an uneconomical way of utilising gravity to transform energy which is the technical name for the power of doing work, because the person carrying the bottle to the upper window carries himself there too, and he being much heavier than the bottle, requires a much greater expenditure of energy in the process than is applied to the smashing of the bottle.

(2.)—A falling mass instead of being set to smash itself may be made to do other work. Thus the great wooden piles on which buildings are reared on marshy ground, or the piers of a bridge built in a river are driven into the ground by dropping a weight on them. The pile is placed in position below a lofty frame from which

a mass of iron is dropped upon it. The force of the impact drives the pile a little distance into the ground and the mass of iron is raised again to the top of the frame by a couple of workmen turning a winch The energy they expend against gravity by raising the mass of iron is transformed into work done in driving home the pile. If the mass of iron is doubled and raised to the same height, twice as much work is done by it as it falls.

(3.)—A grandfather's clock is driven by the same power as a pile driver; that is to say, by the descent of weight that has been wound up to some definite height above the ground. But instead of being allowed to fall the whole distance at once, as in the pile-driving, the weight in the clock has its fall regulated by the escapement and pendulum, which allow it to fall so slowly that it takes a whole week to reach the ground. All the time it has been doing work against friction in turning the wheels of the clock and keeping the pendulum swinging against the resistance of the air. When the weight reaches the floor of the clock case it rests quietly upon it, for it has done its work in driving the clock and making the wheels go round. Thus it is obvious that the work of a raised weight falling under the influence of gravity can be made to turn machinery which in the case of the clock moves the hands or strikes the bell, though it could be made to run a sewing machine or turn a roast.

Passengers who land at Madeira to see the Mount Church frequently return to the lower town in a "running carro," a basket-work sledge which glides and sweeps over the polished pebbles paving the steep narrow lanes with no motive force but gravity, and is dexterously steered round the most alarming corners by the agile guide, who rides behind. But the exulting rush of the carro is only possible because it has been carried uphill on the head of a toiling porter, whose work done against gravity is the real source of energy.

(4,)—The steep railway which conveys stones from a quarry on the hill-side to the plain below is often so fitted that the loaded trucks descending by the action of gravity pull up the empty trucks the weight of which acts as a brake preventing the too rapid descent of the loaded waggons. The only mechanism required is a pulley at the top and a rope or chain passing round it and connecting the two sets of trucks. An elaboration of this simple arrangement is found in the funicular railways familiar at seaside resorts, in towns like Valparaiso and at mountain villages on the continent. Here a pair of cars running on a steep railway with safety devices to reduce risk are connected by a wire cable which passes round a wheel at the top. Passengers going down enter the top car, those going up enter the bottom car simultaneously, and if the top car has a smaller weight of passengers, water is allowed to flow into a tank which it carries until the increased weight counter-balances the

lower car, which is drawn up as the other descends. Here we find water-power at last. It acts simply by its weight, like the falling bottle, the block of the pile-driver, the weight of the grandfather's clock, the passengers of the running carro, or the stones from the quarry.

Whatever the material may be that has been utilized by gravity to do work, it possessed the power of doing work in a potential form when it rested at the high level; it possesed the power of doing work in a moving or kinetic form when it was falling or sliding or rolling from the high level to the ground; but when it rested on the ground it possessed no power of doing work whatever. It has to be lifted up to a high level again before it regains its power of doing work, and the only means of doing this is by expending energy upon it in raising it against the resistance of gravity. The essential fact which has been ascertained is that gravity enables a falling body to do just as much work in descending from a given height as was expended in raising the body to that height; no more and no less.

No accounts can be kept of the expenditure of money without the use of units by which it may be measured, and the same is true of work. The unit by which work against gravity can be measured is compounded of the weight raised and the vertical distance or height through which it is raised. Any units can be employed, a gramme of weight and a centimetre of height, or a pound of weight and a foot of height; in either case we have an adequate measure, the centimetre-gramme, or the foot-pound. It is a matter of convenience only whether we use the smaller or the larger unit just as it is a matter of convenience only whether we count our money in francs, dollars or pounds. Keeping for the present to the old British units by which the laws of energy were first investigated we shall use the foot-pound as the unit of work. If the bottle in our example (1), weighed 1 lb. and the windows of each floor were successively 10 feet above the floor below, the work done in carrying the bottle (neglecting that done in carrying the person) to the first floor was 10 foot pounds, to the second floor, 20 foot pounds, and to the third floor, 30 foot pounds, and the work expended in smashing the bottle from the three positions was, 10, 20 and 30 foot-pounds respectively. So in example (2), if the height of the frame of the pile driver at first was 10 feet above the head of the pile, and the weight 100 lb., it would do 1,000 foot-pounds of work when it fell, or if the weight were 200 lbs. it would do 2,000 foot-pounds of work when it fell. Generalizing this we get the statement that the amount of work which a given weight can accomplish depends only on the height from which it falls; and conversely the amount of work which can be accomplished by a body falling from a given height depends only on its weight.

(*To be continued.*)

CLOUD FORMS.

By Lieut. A. S. Martin-Smith.

Not least among the luxuries which we have had to forego during the war is the daily issue of weather forecasts from the Meteorological Office. We have had to rely almost exclusively upon our own experience of sky indications, together with an individual use of the barometer.

If we ask ourselves—have we suffered a great deal of inconvenience thereby, I wonder how many of us can honestly answer that question in the affirmative. I do not think that I get caught unawares by the elements more frequently now than in the days when we had other people to think for us.

Surely it must have occurred to some of us that there is room for improvement, and that therefore in this, as in other spheres of activity, the time to act is now, not after the conclusion of peace. Possibly steps with that end in view may already have been taken, even so I venture to suggest that in the past there has not, by any means, been an adequate appreciation of the valuable service of which the intelligence to be derived from the systematic observation of clouds is capable of affording the professional meteorologist especially when engaged in forming his forecasts. If the forfeiture of my life depended upon the correctness or otherwise of a weather forecast for any given day I would prefer to rely on the one based upon cloud reports rather than that derived from the study of a similar number of barometer readings.

The recent publication by the Meteorological Office of an illustrated booklet on Cloud Forms must meet with the warm approval of all who consider it desirable to bring at least one branch of meteorological knowledge within the mental grasp of the ordinary man. The photographic reproductions therein of Mr. Clarke's cloudscapes do neither him nor themselves justice. Excessive intensification is so obvious.

After perusing the introductory remarks one is tempted to regret that reference is not made to the charming book of Cloud Studies by A. W. Clayden.

What is disappointing and tends to shake one's faith in the efficacy of isobaric charts is the frequent omission of any reference to the probability of an electrical disturbance in the forecast for a day during which takes place a particularly awe-inspiring display of Nature's fireworks. It can hardly be denied that pre-war forecasts betrayed a marked timidity in this respect.

I lay particular stress on the occurrence of thunderstorms because they are the most truly splendid and self-assertive of all meteorological phenomena in this country and possess a peculiar power of making themselves felt by every one. I can honestly say that

during ten years or so of cloud study as a form of recreation, never have I had a thunderstorm take me by surprise, although I will not go so far as to assert that results have invariably justified the anticipation.

I am convinced that by the encouragement and development, along scientific lines, of the study of clouds, much useful work could be accomplished, more particularly with reference to the occurrence of thunderstorms and phenomena similarly elusive to the forecaster. With the notable exception of Mr. Fairgrieve's work, is there in existence a complete or anything approaching a complete and faithful record of the cloud history of any given thunder system? If not, why not?

The following suggestions are here put forward :—

(1.) That propaganda be instituted with a view to arousing an intelligent interest in things meteorological, particularly with regard to cloud study.

(2.) That a public appeal be made for photographs of clouds, and subsequently the formation at the Meteorological Office or elsewhere of a collection comprising a selection of the best available.

(3.) The establishment of an increasing number of auxiliary cloud stations and arrangements made for the telegraphic transmission of reports.

(4.) The thorough investigation of thunderstorm systems with particular reference to the cloud antecedents.

There are several thousands of voluntary rainfall Observers in this country and I am sure that from these alone some hundreds would be found both capable and willing to render this additional service.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

BAROMETRIC PRESSURE AND THUNDERSTORMS.

THOUGH thunderstorms—at least of the more intense type—are generally associated with hot weather, I think it is a mistake to suppose, as some people do, that they are independent of the barometer. According to my experience, thunder rarely develops, even in very hot weather, while the pressure is decidedly high.

I think records would show that thunder is most commonly experienced during cyclone or semi-cyclone weather (in the season of strong sun) or that, in other words, the majority of storms, even in summer, are of a semi-cyclonic nature. G. WESTON.

47, Chester Terrace, S.W. 1, August 22nd, 1918.

INFLUENZA AND WEATHER IN LONDON.

By Chas. Harding.

There is in most minds a lurking suspicion, if nothing more, that influenza is associated in some way with the weather, but a fairly close examination of several epidemics with the accompanying weather conditions fails to show any very definite connection. In the past 80 years there have been in London some 32 epidemics. Sir Arthur Mitchell and Dr. Buchan, in a discussion published in 1890, showed five epidemics in the 45 years from 1845 to 1890, and an examination of the Registrar General's returns from 1891 to 1918 shows 27 epidemics. Dealing with the records from 1891, the disease is considered epidemic when 20 deaths occur in a week and this number or more is maintained for successive weeks.

By far the majority of epidemics have occurred in winter and spring, but the disease seems in no way associated with cold weather. In the epidemics discussed by Mitchell and Buchan the authors say that the epidemics occur "rather with exceptionally warm weather, which manifests itself generally both before and during the epidemic." With the waning of the epidemic the temperature is generally much below the average. The epidemics subsequent to 1890 confirm this statement with regard to the accompanying weather, but in some cases the temperature was very variable.

Heavy rains commonly accompany the epidemics and the attack during the present summer was at its worst in July, when it will be remembered that the rainfall in South London was a record, not only for July, but there has only been one wetter month at any period of the year for the last 100 years. The present epidemic has occurred with exceptionally mild and humid weather, the night temperatures being frequently 10° above the average. It should be mentioned, however, that in London wet weather is as a rule by no means unhealthy, the rain washing the dust and impurities from the atmosphere; 1903, the wettest year on record, was one of the healthiest ever experienced; the deaths in London were 15,000 fewer than the average of the previous ten years.

Belville, in his journal for 1837, says: "The complaint known by the name of the influenza prevailed during January and February, attended by a great mortality—the deaths were alarming." The cold in March was said to be "more severe than ever known to have been felt." January and February were wet and fairly mild.

In the forty-five years dealt with by Mitchell and Buchan epidemics occurred in the years 1847-48, 1850-51, 1855, 1857-58 and 1889-90. During the forty-five years the total deaths due directly to influenza in London were 4,690, and the five epidemics yielded 2,687 deaths. In the more recent years, from 1891 to 1918

(to October 26th), deaths in London in the epidemics from influenza alone were 23,071.

Influenza sadly requires further enquiry. There is need for very special discussion. It has been asserted that the summer and present epidemics resemble greatly the epidemic of 1890; an examination of the facts, however, shows very many differences.

In 1890 the total deaths during the epidemic in London from influenza were 3 per cent. of the deaths from all causes; deaths from pneumonia were 8 per cent., and from bronchitis, 20 per cent. In the epidemic of 1892, which was apparently the worst prior to the present attack, the deaths were respectively 7, 8 and 22 per cent. In the epidemic during the past summer, 11 per cent. of all deaths occurred from influenza, 9 per cent. from pneumonia, and 4 per cent. from bronchitis. The autumn attack now in progress has from influenza 32 per cent. of the deaths from all causes, 11 per cent. from pneumonia, and 6 per cent. from bronchitis.

In the epidemics prior to the present year deaths occurred mostly at ages above 40 or 45 years. This year deaths were most numerous between the ages of 20 and 45. In the epidemic now in progress influenza deaths between the ages of 5 and 20 were 54 per cent. of the deaths from all causes at those ages, and between 20 and 45 were 53 per cent. of the total deaths at the respective ages, whilst between 45 and 65 the percentage was 22, from 65 to 75, 10 per cent., and above 75 years only 4 per cent. In the week ending October 26th, fully two-thirds of the total deaths between ages 5 and 45, were from influenza.

OUR RAINFALL TABLES.

We have received a great many letters from readers expressing regret, disappointment and indignation at the non-appearance of our Rainfall Tables. With these we fully agree, but it is not in our power to move the mountain which has blocked the way. Our correspondents make various guesses, most of them correct, as to the nature of this mountain, and several wish us to explain exactly what it is. We are reluctant to do this at present for two reasons. We do not wish to embarrass anyone who has important duties to attend to, and at present we cannot trust ourselves to write with editorial calmness on a subject on which we feel so intensely.

We hope to be able to say something to the purpose in our next issue, and we cordially thank those Observers who have not failed to send in their records in spite of the irritating and unnecessary postponement of publication.

Climatological Table for the British Empire, May, 1918.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	87·5	21	38·9	9	69·1	47·8	...	76	127·5	33·1	2·11	11	6·0
Malta	78·3	26	56·2	1	70·7	60·7	...	77	133·5	52·5	·20	1	1·0
Lagos	91·4	14	70·0	24	88·6	74·9	73·7	73	148·3	69·0	7·85	16	7·2
Cape Town	83·6	19	39·7	30	66·9	52·0	50·1	73	...	...	4·61	12	5·4
Johannesburg	72·0	6	24·9	30	62·0	42·9	38·7	70	...	22·4	·21	3	2·2
Mauritius	81·8	4	57·8	28	77·9	64·8	63·5	78	...	50·0	3·73	20	5·3
Bloemfontein	72·1	6	21·0	30	63·0	37·5	38·7	71	..	...	1·17	5	2·4
Calcutta...	96 6	26	70·0	6	92·1	76·6	75·6	80	...	65·3	8·19	8	6·3
Madras	102·8	15	72·7	17	96·3	79·5	74·2	72	156·3	72·9	5·80	7	4·6
Colombo, Ceylon ...	89·5	4	71·2	18	86·4	76·2	74·1	82	161·8	70·9	12·14	21	7·8
Hongkong	86·9	31	66·3	5	80·3	73·1	71·4	84	...	...	6·66	19	8·5
Sydney	77·1	2	45·1	27	69·8	52·5	50·5	74	121·4	37·1	·53	7	3·3
Melbourne	75·7	10	37·1	27	63·2	49·4	47·1	71	127·2	31·9	3·11	14	6·3
Adelaide	86·0	4	43·5	26	70·3	54·7	49·9	63	143·0	35·4	3·37	15	7·0
Perth	78·4	20	40·6	15	68·4	54·4	52·6	74	135·0	30·5	6·36	18	6·4
Coolgardie	79·0	6, 7	38·5	15	68·3	47·5	45·6	61	140·0	32·0	·79	7	5·2
Brisbane	77·9	29	43·5	19	73·0	53·1	53·2	71	139·0	40·1	2·49	12	4·1
Hobart, Tasmania ..	72·0	9	35·2	26	58·7	45·8	41·3	64	113·8	30·2	2·41	16	6·4
Wellington	64·0	12	38·7	28	53·7	39·9	47·0	78	122·0	27·4	4·14	11	5·1
Jamaica, Kingston ...	90·6	17	68·6	14	86·3	71·2	70·9	84	...	...	3·44	7	6·6
Grenada	87·0	sev.	69·0	31	85·0	74·0	...	76	138·0	...	7·93	15	5·0
Toronto	82·0	22	30·0	11	68·6	45·7	45·8	73	132·5	24·3	2·64	13	5·8
Fredericton	89·5	18	26·0	5	65·7	41·6	42·0	64	...	...	2·70	11	5·7
St. John, N.B. ...	63·9	11*a*	32·5	5	55·6	41·5	39·9	74	125·6	27·5	2·07	14	6·4
Victoria, B.C.	68·5	27	40·5	20	59·2	45·0	43·0	72	139·0	35·5	·70	9	4·7

a—22.

Johannesburg.—Bright sunshine 272·3 hours.

COLOMBO, CEYLON.—Mean temp. 81°·3, or 1°·2 below, dew point 1°·3 below, and R ·37 in. below, averages. Mean hourly velocity of wind 5·3 miles.

HONGKONG.—Mean temp. 76°·2. Bright sunshine 124·5 hours. Mean hourly velocity of wind 12·6 miles.

Sydney.—Mean temp., 61°·2, the highest on record.

Melbourne.—Mean temp. 2°·3 above, and R ·93 in. above, averages.

Adelaide.—Mean temp. 4°·8 above, and R ·65 in. above, averages. The warmest May on record.

Perth.—R 2·03 in. above average.

Coolgardie.—Temp. 3° above, and R below, averages.

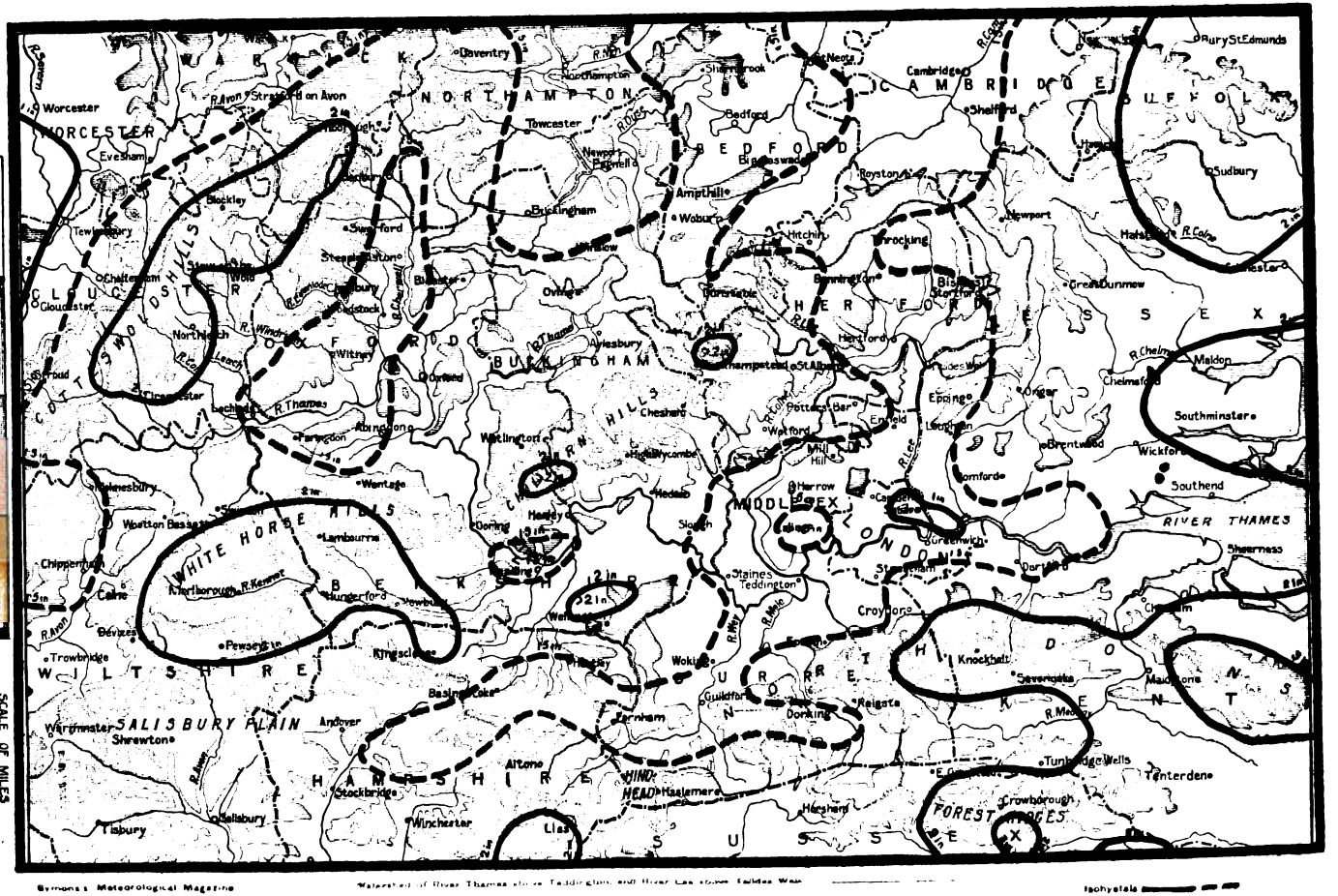
Brisbane.—Mean temp. 2°·1 below, and R ·41 in. below, averages.

Hobart.—Mean temp. 2°·3 above average.

Wellington.—Mean temp. 0°·9 above, and R ·81 in. below, averages. Bright sunshine, 165·6 hours.

EXCHANGE
JAN 0 1919

THAMES VALLEY RAINFALL. OCTOBER, 1918.


ALTITUDE SCALE
Below 250 feet
250 to 500 feet
500 to 1000 feet
Above 1000 feet
SCALE OF MILES
Worcester
Evesham
Stratford on Avon
Daventry
Northampton
Towcester
Bedford
Cambridge
Bury St Edmunds
Sudbury
Shelford
Newport
Great Dunmow
Maldon
Chelmsford
Southminster
Southend
Wickford
Brentwood
Ongar
Epping
Harlow
Hitchin
Wobum
Ampthill
Buckingham
Aylesbury
Chesham
Watford
Hatfield
Hertford
Bishop's Stortford
Royston
Newport
Saffron Walden
Thame
Wallingford
Abingdon
Oxford
Witney
Chipping Norton
Cheltenham
Gloucester
Stroud
Cirencester
Tetbury
Malmesbury
Swindon
Marlborough
Hungerford
Newbury
Basingstoke
Andover
Salisbury
Shrewton
Warminster
Trowbridge
Devizes
Chippenham
Calne
Wantage
Wallingford
Henley
Reading
Slough
Windsor
Staines
Teddington
Harrow
Hendon
Enfield
Barnet
Watford
Hemel Hempstead
St Albans
Luton
Dunstable
Bedford
Biggleswade
Sandy
Shefford
Ampthill
Woburn
Buckingham
Towcester
Daventry
Rugby
Coventry
Warwick
Stratford on Avon
Evesham
Worcester
Tewkesbury
Cheltenham
Gloucester
Stroud
Cirencester
Tetbury
Malmesbury
Swindon
Wantage
Abingdon
Oxford
Witney
Chipping Norton
Banbury
Brackley
Towcester
Northampton
Daventry
Rugby
Coventry
Warwick
Stratford on Avon
Evesham
Worcester
Tewkesbury
Cheltenham
Gloucester
Stroud
Cirencester
Tetbury
Malmesbury
Swindon
Marlborough
Hungerford
Newbury
Basingstoke
Andover
Salisbury
Shrewton
Warminster
Trowbridge
Devizes
Chippenham
Calne
Wantage
Wallingford
Henley
Reading
Slough
Windsor
Staines
Teddington
Harrow
Hendon
Enfield
Barnet
Watford
Hemel Hempstead
St Albans
Luton
Dunstable
Bedford
Biggleswade
Sandy
Shefford
Ampthill
Woburn
Buckingham
Towcester

PUBLICATION POSTPONED BY ORDER OF CHIEF CENSOR, ADMIRALTY.

RAINFALL TABLE FOR OCTOBER, 1918.

STATION.	COUNTY.	RAINFALL. Aver. 1875—1909. in.	1918. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Date.	Nos. of Day
Camden Square	*London*	2·72	1·23	—1·49	45	·19	11	16
Tenterden	*Kent*	3·48	2·35	—1·13	68	·56	20	17
Arundel (Patching)	*Sussex*	4·01	1·80	—2·21	45	·37	14	13
Fordingbridge (Oaklands)	*Hampshire*	3·97	1·91	—2·06	68	·33	10	18
Oxford (Magdalen College)	*Oxfordshire*	2·82	1·80	—1·02	64	·45	16	22
Wellingborough (Swanspool)	*Northampn*	2·60	1·40	—1·20	54	·27	11,14	13
Bury St. Edmunds (Westley)	*Suffolk*	2·72	2·28	— ·44	84	·94	11	16
Geldeston [Beccles]	*Norfolk*	2·84	2·71	— ·13	95	·83	11	20
Polapit Tamar [Launceston]	*Devon*	4·84	3·07	— 1·77	63	·44	15	25
Rousdon [Lyme Regis]	,,	3·81	2·18	—1·63	57	·46	8	21
Stroud (Field Place)	*Gloucester*	3·21	1·08	—2·13	34	·13	9	19
Church Stretton	*Shropshire*	3·77	1·95	—1·82	52	·36	5	22
Boston	*Lincoln*	2·75	1·91	— ·84	69	·63	11	21
Worksop (Hodsock Priory)	*Nottingham*	2·77	1·14	—1·63	41	·18	9	17
Mickleover Manor	*Derbyshire*	2·81	1·24	—1·57	44	·35	9	16
Congleton (Buglawton Vic.)	*Cheshire*	3·10	1·48	—1·62	48	·32	9	24
Southport (Hesketh Park)	*Lancashire*	3·74	3·28	— ·46	88	·64	9	19
Wetherby (Ribston Hall)	*York, W.R.*	3·18	1·49	—1·69	47	·38	21	10
Hull (Pearson Park)	,, *E.R.*	3·19	1·17	—2·02	37	·44	9	17
Newcastle (Town Moor)	*North'land*	3·20	2·41	— ·79	75	·70	19	18
Borrowdale (Seathwaite)	*Cumberland*	12·71	15·55	+2·84	122	...	...	...
Cardiff (Ely)	*Glamorgan*	4·87	2·67	—2·20	56	·50	5	26
Haverfordwest	*Pembroke*	5·51	5·76	+ ·25	105	·83	31	28
Aberystwyth (Gogerddan)	*Cardigan*	5·38	5·31	— ·07	99	1·18	4	21
Llandudno	*Carnarvon*	3·78	2·38	—1·40	63	·35	5	22
Cargen [Dumfries]	*Kirkcudbrt.*	4·45	6·38	+1·93	143	·96	3	25
Marchmont House	*Berwick*	3·83	3·59	— ·24	94	·46	17,18	20
Girvan (Pinmore)	*Ayr*	5·38	6·82	+1·44	127	1·36	4	26
Glasgow (Queen's Park)	*Renfrew*	3·36	5·02	+1·66	150	·70	5	21
Islay (Eallabus)	*Argyll*	4·95	7·03	+2·08	143	·77	3	27
Mull (Quinish)	,,	5·87	8·14	+2·27	139	1·04	9	26
Balquhidder (Stronvar)	*Perth*	7·29	11·62	+4·33	160	2·00	6	22
Dundee (Eastern Necropolis)	*Forfar*	2·81	2·75	— ·06	98	·51	18	20
Braemar	*Aberdeen*	3·88	4·23	+ ·35	109	·80	18	15
Aberdeen (Cranford)	,,	3·23	2·59	— ·64	80	·30	4	23
Gordon Castle	*Moray*	3·38	1·73	—1·65	51	...	...	...
Drumnadrochit	*Inverness*	3·49	4·40	+ ·91	126	·94	6	22
Fort William	,,	7·32	11·33	+4·01	155	2·89	9	26
Loch Torridon (Bendamph)	*Ross*	8·38	13·02	+4·64	155	1·75	9	26
Dunrobin Castle	*Sutherland*	3·15	1·68	—1·47	54	·36	7	14
Glanmire (Lota Lodge)	*Cork*	4·35	3·57	— ·78	82	·50	3	19
Killarney (District Asylum)	*Kerry*	5·59	7·41	+3·82	133	1·33	5	26
Waterford (Brook Lodge)	*Waterford*	4·00	4·01	+ 01	100	·97	3	20
Nenagh (Castle Lough)	*Tipperary*	3·48	5·62	+2·14	160	·87	5	21
Ennistymon House	*Clare*	4·40	6·96	+2·56	158	1·44	2	22
Gorey (Courtown House)	*Wexford*	3·75	4·01	+ ·26	107	1·05	3	19
Abbey Leix (Blandsfort)	*Queen's Co.*	3·53	3·70	+ ·17	105	·60	3	20
Dublin (Fitz William Square)	*Dublin*	2·88	2·36	— ·52	82	·41	3	21
Mullingar (Belvedere)	*Westmeath*	3·19	4·05	+ ·86	127	·61	6	21
Crossmolina (Enniscoe)	*Mayo*	5·27	7·92	+2·65	150	1·19	5	26
Cong (The Glebe)	,,	4·60	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	4·21	5·78	+1·57	137	·96	7	26
Seaforde	*Down*	3·65	3·62	— ·03	99	·82	8	25
Ballymena (Harryville)	*Antrim*	3·78	4·24	+ ·46	112	·55	8	27
Omagh (Edenfel)	*Tyrone*	3·76	5·46	+1·70	145	·63	2	25

PUBLICATION POSTPONED BY ORDER OF CHIEF CENSOR, ADMIRALTY.

SUPPLEMENTARY RAINFALL, OCTOBER, 1918.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Warlingham, Redvers Road..	2·52	XI.	Lligwy	5·05
,,	Ramsgate	2·14	,,	Douglas, Isle of Man	5·50
,,	Hailsham	3·08	XII.	Stoneykirk, Ardwell House...	4·24
,,	Totland Bay, Aston House...	1·91	,,	Carsphairn, Shiel	11·66
,,	Stockbridge, Ashley..	1·82	,,	Langholm, Drove Road	6·51
,,	Grayshott	1·75	XIII.	Selkirk, The Hangingshaw..	2·70
III.	Harrow Weald, Hill House...	1·32	,,	North Berwick Reservoir	2·07
,,	Pitsford, Sedgebrook....	1·34	,,	Edinburgh, Royal Observaty.	2·78
,,	Woburn, Milton Bryant	1·56	XIV.	Biggar	4·69
,,	Chatteris, The Priory	1·06	,,	Maybole, Knockdon Farm ...	6·40
IV.	Elsenham, Gaunts End	1·66	XV.	Buchlyvie, The Manse	6·57
,,	Shoeburyness	1·78	,,	Ardgour House	14·73
,,	Colchester, Hill Ho., Lexden	1·70	,,	Oban	8·29
,,	Ipswich, Rookwood, Copdock	2·11	,,	Campbeltown, Witchburn ..	...
,,	Aylsham, Rippon Hall	2·75	,,	Holy Loch, Ardnadam	8·73
,,	Swaffham	1·82	,,	Tiree, Cornaigmore	...
V.	Bishops Cannings	1·96	XVI.	Glenquey	6·70
,,	Weymouth	1·33	,,	Loch Rannoch Dall	6·29
,,	Ashburton, Druid House..	3·34	,,	Blair Atholl	4·40
,,	Cullompton	1·98	,,	Coupar Angus	2·51
,,	Lynmouth, Rock House ..	2·99	,,	Montrose, Sunnyside Asylum.	2·20
,,	Okehampton, Oaklands...	2·92	XVII.	Balmoral	3·03
,,	Hartland Abbey	2·83	,,	Fyvie Castle	2·23
,,	St. Austell, Trevarna	4·13	,,	Keith Station ..	3·16
,,	North Cadbury Rectory	1·65	XVIII.	Rothiemurchus	3·18
VI.	Clifton, Stoke Bishop	2·04	,,	Loch Quoich, Loan	27·13
,,	Ledbury, Underdown	1·17	,,	Skye, Dunvegan	10·54
,,	Shifnal, Hatton Grange	1·63	,,	Fortrose	2·41
,,	Droitwich	1·64	,,	Glencarron Lodge	...
,,	Blockley, Upton Wold	2·14	XIX.	Tongue Manse	2·66
VII.	Grantham, Saltersford	1·47	,,	Melvich	1·95
,,	Louth Westgate	1·39	,,	Loch More, Achfary	9·39
,,	Bawtry, Hesley Hall	·97	XX.	Dunmanway, The Rectory ..	7·20
,,	Whaley Bridge, Mosley Hall	2·73	,,	Mitchelstown Castle	3·80
,,	Derby, Midland Railway	1·25	,,	Gap of Dunloe Gearahameen	15·50
VIII.	Nantwich, Dorfold Hall	1·59	,,	Darrynane Abbey	6·37
,,	Bolton, Queen's Park	5·31	,,	Clonmel, Bruce Villa	3·33
,,	Lancaster, Strathspey	4·10	,,	Broadford, Hurdlestown	5·30
IX.	Langsett Moor, Up. Midhope	2·26	XXI.	Enniscorthy, Ballyhyland...	5·30
,,	Scarborough, Scalby	1·48	,,	Rathnew, Clonmannon	2·88
,,	Ingleby Greenhow	...	,,	Ballycumber, Moorock Lodge	3·53
,,	Mickleton	2·80	,,	Balbriggan, Ardgillan	2·77
X.	Bellingham, High Green Manor	4·82	,,	Castle Forbes Gardens	4·85
,,	Ilderton, Lilburn Cottage ...	3·44	XXII.	Ballynahinch Castle	7·18
,,	Keswick, The Bank	9·66	,,	Woodlawn	3·71
XI.	Llanfrechfa Grange	3·07	,,	Westport, St. Helens	7·03
,,	Treherbert, Tyn-y-waun	7·44	,,	Dugort, Slievemore Hotel ...	10·81
,,	Carmarthen, The Friary	5·59	XXIII.	Enniskillen, Portora	3·95
,,	Fishguard, Goodwick Station.	7·19	,,	Dartrey [Cootehill]	4·31
,,	Crickhowell, Tal-y-maes	7·00	,,	Warrenpoint, Manor House ..	3·50
,,	Gwernargllwydd	1·60	,,	Belfast, Cave Hill Road	4·41
,,	Birmingham WW., Tyrmynydd	4·59	,,	Glenarm Castle	4·26
,,	Lake Vyrnwy	...	,,	Londonderry, Creggan Res...	5·15
,,	Llangynhafal, Plas Drâw	2·44	,,	Milford, The Manse	4·56
,,	Rhwibryfdir	16·99	,,	Killybegs	8·50
,,	Dolgelly, Bryntirion	6·18			

Symons's
Meteorological Magazine.

No. 635. DECEMBER, 1918. Vol. LIII.

PEACE AND PROSPECTS.

The war has ended as all free and honourable peoples hoped and expected when it began. We concluded our first reference to the war in the number for September, 1914 (vol. **49**, p. 141) with the words referring to the introduction by the enemy of terrorist methods towards civilians :—

"May not the originator of such a policy fear that his name in history may be changed, like that of Pashur, the son of Immer, to Magormissabib—a terror to himself and to all his friends."

It seems now that the curse of Jeremiah has indeed fallen upon the German Kaiser in full measure.

In the winning of the war by force in the trenches and by mental toil on the Staff and in the scientific departments, meteorologists and Observers have done their part, like all their countrymen, and many have paid the utmost price. As members of the public we still know little of what the men in the Navy and the Army have done and suffered, for some reason unknown a little more has been allowed to appear regarding individual prowess in the Air Service.

The hatefulness of militarism as the guiding spirit of a nation has been proclaimed by the action of the German forces by land, sea and air, and the necessity of meeting force with force has brought the lesson nearer to us than the enemy was ever able to reach. The Defence of the Realm Act gave powers to public officials such as have never before been exercised in Great Britain, and all must agree that these powers were exercised with reason and moderation, and submitted to with a patriotic docility hardly to be expected from a people so much accustomed to their own way as we are. But while this is true, on the whole, there were, of course, inevitable instances of individual hardship and injustice that have been borne as parts of the evils of war, though felt the more deeply because the reason which made them inevitable was kept secret.

With the return of peace most of the grievances will gladly be forgotten or even forgiven. We cannot but wonder why the daily

weather forecasts were allowed to be published for so long after all meteorologists recognized, and many had urged upon the Government, the importance of keeping such valuable information from the enemy. It was right and necessary that such information should be kept from those to whom predictions of the weather over the British Isles were essential in the planning of air-raids or attacks from the sea. But when at last the fighting forces understood the value of keeping useful information from the enemy their expert advisers unfortunately sometimes failed to distinguish between information useful only to ourselves, though not to the enemy, and that which was in some way helpful to the latter.

It was only in August, 1918, when the war was practically won, that we were warned by the Admiralty that the publication of monthly totals of rainfall was an offence against that Act, which the humourist cites as Dora, and our Rainfall Tables had accordingly to be suppressed until this month. To us this appeared to be not only an unnecessary but a stupid and humiliating proceeding. These Tables could not assist any scientific meteorologist to forecast the weather of the British Isles on any future day. The expert advisers of the Admiralty when they suggested the suppression of monthly rainfall figures were, we fear, either ignorant of the limitations which beset the powers even of German meteorologists, or they were actuated by motives not in any way connected with the Defence of the Realm. The embargo at one time seemed to threaten the continued existence of this Magazine, but its short duration has averted the fatal effect. We should, perhaps, not take it seriously but content ourselves with Ian Hay's suggestion that the orders issued by the Authorities are sometimes expedited through the Practical Jokes Department, and invite our readers to laugh with us at the breezy humour of the jolly old sea-dogs in the rollicking diversions of Jack ashore. In any case the suppressed Tables and maps are sent out with this number and we are free once more to serve the public by passing on the devoted work of the rainfall Observers to those who are waiting to apply it to the practical good of mankind.

The problems of collective scientific work after the war have now to be faced. At home it is obvious that progress which has been arrested or reduced to the minimum compatible with existence must be re-started and accelerated so as to make up as speedily as possible for lost time. In our own small department it seems to us that the main problem is the more effective organization of voluntary effort and the fuller public recognition of voluntary work. This should be done in such a way as to strengthen and derive strength from the various public services which have to do with the air and these are legion. Here there is neither occasion nor room for rivalry, but an abounding opportunity for union and co-operation.

A much more difficult problem is presented by the shattered systems of international co-operation. The suggestion has been made, and in some departments of science it might be possible, that future international co-operation for some time to come should exclude the people of what were the central empires. In meteorology this is impossible. Records from the whole surface of the Earth must be obtained and the systems of observing re-established and maintained. We have shattered the military system which was our enemy, and it is the duty of men of science to resume their work with no spirit of personal animosity.

METEOROLOGICAL NEWS AND NOTES.

THE ROYAL METEOROLOGICAL SOCIETY asks, through its Secretary, that readers who have spare copies of the following which they no longer require will be kind enough to return them to 70, Victoria Street, S.W.1 :—*Quarterly Journal*, Nos. 121 (Jan., 1902), 122 (April, 1902), 141 (Jan., 1907), 162 (April, 1912), and any previous to No. 28 (1878). Also *Phenological Report* reprints, especially previous to 1911.

THE DAILY WEATHER REPORT of the Meteorological Office was re-issued on November 20th, for the first time since August 22nd, at which date even deferred publication was prohibited by the Censor. The missing numbers have since been issued. At the same time weather reports are again appearing in the daily press, though with less prominence than formerly, *The Times* in particular not having resumed its full and valuable daily reports.

THE PROHIBITION OF WEATHER REPORTS during the war made it impossible to publish numerous interesting letters in our correspondence pages and we much regret that most of these must now be omitted on account of pressure on our space.

THE RELATION OF RAINFALL TO CONFIGURATION forms the subject of a paper by Mr. Carle Salter read before the Institution of Water Engineers on December 13th, in which it is shown that the average rainfall during 30 to 40 years is intimately dependent upon the land configuration in relation to prevailing winds. The causes of the variations in the relationship are examined in some detail. Another aspect of the same subject is touched upon in a recent paper on the Tata Hydro-Electric Works, Bombay, by Mr. R. B. Joyner, C.I.E , read to the Institution of Civil Engineers, in which it is claimed, we think without justification, that the monsoon rainfall is affected by the formation of large artificial lakes.

BRITISH RAINFALL, 1917.*

THE fourth volume of *British Rainfall* compiled under war conditions, and the fifty-seventh of the series, has been delayed in publication chiefly by the great difficulties of printing and engraving, and in a less measure by the continued absence on war service of several of the most experienced members of the staff of the Organization. Reference is made to the loss sustained by the death from wounds of Sec.-Lt. D. S. Salter, who had been for several years in charge of the cartographical work.

The absolute necessity for economy in money, labour and paper has compelled the restriction of the volume to the smallest limits compatible with the maintenance of all essential features, and this has been effected by the shortening of the letterpress, the reduction of the number of illustrations and by more compact type-setting of the tabular matter. The statistics are given in full in order to avoid any break of continuity with former volumes, and so are the monthly and annual maps of rainfall.

A feature of unusual interest is the discussion of two daily rainfalls of unprecedented magnitude, occurring respectively on June 16th, in London, and on June 28th, in the south-west of England. The latter, during which occurred a remarkable fall of 9·56 inches of rain during twenty-four hours, at Bruton, in Somerset, forms the subject of a special article, illustrated by a coloured folding map on the scale of 10 miles to an inch. Other remarkable rains of the year took place during the six days from July 29th to August 3rd, in the south-eastern counties, and during the last week of November in the West Highlands.

Articles by Mr. L. C. W. Bonacina, on the Snowfall of 1917, and by Mr. W. R. Nash, on the Variations of Rainfall with Height above the Ground, the latter based on the Greenwich records, and illustrated by diagrams, are also included.

The diminution in the number of rainfall records received for publication, which has been the inevitable result of the war, was smaller in 1917 than had been the case in 1916, and 5,085 complete records appear in Part III. We have every reason to hope that the near future will see this temporary set-back more than counterbalanced by the new impetus being given to scientific work in the period of national re-construction on the threshold of which we now stand.

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* *British Rainfall, 1917*, compiled from the records of more than 5,000 Observers in Great Britain and Ireland. By Hugh Robert Mill and Carle Salter, Joint Directors of the British Rainfall Organization. London, Stanford, Size, 9 × 6, pp. 288, 3 plates and 29 illustrations in text.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

CLOUD FORMS IN FORECASTING.

THE article by Lt. A. S. Martin-Smith in the November number advocating the more systematic study of clouds to supplement the data upon which forecasts are based is much to be commended. The study of clouds is a most attractive side of meteorology if only on account of the supreme beauty of many cloud-forms, and their groupings in the sky. I can thoroughly uphold a specific point which Lt. Martin-Smith makes, namely, that no diligent student of the sky need ever be caught unawares by a thunderstorm—at all events of the summer type. But I venture to criticise the contention implied in the following sentence :—" If the forfeiture of my life depended upon the correctness or otherwise of a weather forecast for any given day I would prefer to rely upon the one based upon cloud reports rather than that derived from the study of a similar number of barometer readings." Now frankly I would not, and for two reasons. Firstly, the distribution of barometric pressure bears a known mathematical relation to the force and direction of the wind, and what is wind, if not a part of the very weather itself? But I have yet to learn that any particular type of cloud has any such certain and invariable connection with the weather of which it is the precursor. Secondly, the record of a barometric height is an unambiguous statement of something, namely, the local pressure of the atmosphere which is measured with absolute precision, or with as much precision as is necessary. But to get a cloud record to vie in precision with a barometric reading, we should require either a photograph, a painting or an elaborate word-picture of the cloud, any of which would be hopelessly impracticable in synoptic meteorology. So we are driven to adopt a sort of short-hand system of cloud recording, classifying each individual cloud into one or other of a number of species and sub-species. But in all procedure founded on systems of classification there are two sources of trouble (1) Nature is so abhorrent at having her phenomena subjected to cut and dried schemes of classification, that she always leaves a number of intermediate forms to frustrate them, and, (2), no two minds will ever relegate natural objects to a number of types or species with anything like accordance. The real value of clouds in local weather prevision lies in the almost indescribable *picture* they present to the individual mind; but it is very difficult to transmit such a picture to another mind, and even if it were easy, it would be impracticable to do so in official reports. By all means let us have cloud observations in official meteorology, but to supplement, not supplant, barometric readings.

Hampstead, December 4th, 1918. L. C. W. BONACINA.

THE USE OF WATER POWER.

THERE is an application of Water Power, which, I think, may be seen in the "peaceful" days to come. Might not the many disused corn-mills, in hilly districts, driven by either over-shot or under-shot water-wheels be harnessed to produce electricity in country places? In Devonshire coal costs so much that making electricity by means of it for farm work or cottage lighting is out of the question. Meanwhile, countless mills with water laid on and even machinery in order, to a certain extent, lie idle. L.J.B.G.

November 18th, 1918.

[We believe that our correspondent's suggestion is already being put into application in many parts of the country.—ED., *S.M.M.*]

UNUSUAL TEMPERATURE RANGE.

IN the number of your valuable Magazine for May last, Mr Dines mentions two instances of a daily temperature range of 41° and 42° respectively. I do not know what the world record is in this respect, but one thing of the kind which I experienced many years ago at the other side of the world I am tempted to mention, viz, a fall of 50° in one half-hour, on a summer afternoon, I think, in 1857, when on the third day of the well known Melbourne hot wind, blowing from N.N.W., the wind suddenly changed to S., and the temperature fell from 110° to 60°, with most refreshing result to the whole creation, animal and vegetable. W. M. COOPER.

Wroxall, Isle of Wight, September 21st, 1918.

ROYAL METEOROLOGICAL SOCIETY.

THE first monthly meeting of this Society for the present session was held on November 20th at the Society's Rooms, 70, Victoria Street, Westminster, Sir Napier Shaw, F.R.S., President, in the Chair.

A paper by Prof. R. de C. Ward, of Harvard College, Cambridge, Mass., entitled "The larger relations of climate and crops in the United States," was read by the Foreign Secretary in the absence of the author. For the purpose of his enquiry Prof. Ward divides the States into two major divisions separated by the mean annual

rainfall line of 20 inches, which forms the eastern boundary of the Great Plains. These are again divided into agricultural districts or belts as a framework into which the larger facts of climate and crop distribution, and of types of farming are fitted. The eastern half of the country has sufficient rain in normal years and ordinary farming methods are followed. The western half, with generally inadequate rainfall, is a region of irrigation, of dry farming and of grazing. Here there are no great belts distinguished by certain dominant crops as in the east, the crops are very varied, often extremely localized. The crops in both divisions are discussed with much detail as to the influence of climatic factors. A comprehensive bibliography is appended.

A paper by Captain C. J. P. Cave, R.E., and Mr. J. S. Dines, entitled "Soundings with Pilot Balloons in the Isles of Scilly, November and December, 1911," was also read. The ascents were made to ascertain the wind structure in a place where the effect of land masses may be regarded as at a minimum. The Scilly Isles consist of a small group of islands 25 miles S.W. of Land's End. The greatest height above sea-level does not much exceed 150 feet. The period covered by the observations, November 22nd to December 8th, marked the setting in of a south-westerly type of pressure distribution with low pressure over Iceland. This type became well developed by November 30th and during the rest of the period several pronounced secondaries passed across the British Isles from the Atlantic. The ascents show that the changes in wind associated with the passage of these secondaries were more marked near the surface than at greater heights. Taking the mean of the ascents the layer in which surface friction made itself felt on the wind velocity was decidedly shallower than at inland stations. The majority of the balloons were followed with two theodolites and the vertical motion computed. The average rate of ascent is found to agree closely with the value given by the formula now generally adopted in this country. There was little change in the mean rate between the ground and 4 kilometres height. In this particular the results differ from those obtained at inland stations where the rate of rising has been found generally to be greater in the first half kilometre than at greater heights.

The following Candidates were elected Fellows of the Society :— Messrs. W. H. Allen, C. D. Anderson, E. H. Bowie, C. W. C. Browne, B. H. Clarke, L. J. Clements, P. T. Creswell, N. I. Curtis, C. B. Dall, Hassan Fahmy, J. Glasspoole, A. Gordon, E. O. Jones, H. Knox-Shaw, G. C. Lawson, T. H. Leadbetter, C. S. Meik, C. W. B. Normand, T. Ormiston, C. S. Payne, A. J. Prince-Cox, Lord St. Audries, S. N. Sen, E. C. Shankland, A. Sparrow, T. Spragg, R. S. Sugden, G. M. Thomas, H. L. de Loud Verry, T. Wain, L. Whitworth.

WORK AND WATER POWER.

By Hugh Robert Mill.

(*continued.*)

It is evident on reflection that foot-pounds do not give a sufficient measure of power. A million pounds of snow on the top of a mountain 10,000 feet high could do 10,000,000,000 foot-pounds of work by falling to sea-level; but if it took a year for the snow to melt and run down to the sea, work could only be done at the average rate of about 20,000 foot-pounds per minute, while if the snow melted and came down in a week it could do 1,000,000 foot-pounds of work per minute, that is to say it would develop about fifty times as much power for the time during which it was operative. Power being devised as the rate of doing work is measured by the number of units of work done in a unit of time. James Watt, for the purpose of stating the power of his steam-engines, introduced the horse-power as a unit, defining it as 33,000 foot-pounds per minute, and this unit of power has become universal for practical purposes. On the Continent it is usual to take the horse-power as equivalent to 4,500 kilogramme-metres per minute.

At this point a digression on units is desirable, though it has no immediate bearing on the scope of this article. The pound or gramme or any weight is not a perfect measure of force. In fact a mass of any material which has the weight of 1 lb. at sea-level in any particular latitude weighs more at sea-level in higher latitudes where the form of the Earth brings it nearer the centre, and less in lower latitudes where the equatorial bulge keeps it farther away. Similarly at distances above sea-level the weight diminishes with the diminishing force of gravity. The difference is not enough to disturb rough practical calculations of horse-power; but in theoretical discussions it is important. Hence for scientific purposes a system of units independent of the varying force of gravity has been devised, and these units are called absolute for that reason. It is a mere accident that the absolute system generally used is expressed in grammes and metres instead of pounds and feet, gravity could be cut out of the British unit of work in exactly the same way as out of the French. The absolute unit of force on the centimetre-gramme and second (C.G.S.) system is the dyne, and that amount of force is enough to produce a velocity of 1 centimetre per second in the mass of 1 gramme after acting upon that mass for 1 second. The unit of work or erg is 1 dyne acting through 1 centimetre, and as this is an extremely minute quantity it is convenient to use the joule, which is equal to 10,000,000 ergs. The unit of power on this system is the watt, which is 1 joule per second; but for convenience the kilowatt of 1,000 watts is generally used, and for all practical purposes 1 kilowatt may be taken as 1·34 horse-power, or 1 horsepower as 746 watts. If one may venture to refer

to vulgar fractions in the same sentence as absolute units one could say with enough truth for most purposes that a kilowatt is $1\frac{1}{3}$ horse-power, and a horse-power is $\frac{3}{4}$ of a kilowatt.

This digression will necessarily fail to explain the essential difference between the two systems of reckoning to any one who did not understand it before; but it may convey a useful hint.

Returning from the discussion of arbitrary units to the real things which they are used to express, I wish to make clear the principles on which the horsepower of falling water can be calculated; but not to intrude on the domain of the engineer by treating of how the calculations are actually made.

It is desirable to bear in mind that although the potential energy possessed by water at a high level is equal to the weight of the water multiplied by the height through which it falls, it by no means follows that all this energy can be converted into useful work. Some is spent in friction of the water flowing along its channel, and some in friction in the machinery by which it is transformed into driving power or into electric energy. The proportion of the theoretical power available is a matter for the mechanical or electrical expert and depends largely on the perfection of the mechanism or processes employed. In an ordinary undershot or overshot water wheel a very large amount of the potential energy is lost; but in a modern turbine working either at low pressure with a large volume of water and a small fall, or at a high pressure with less volume but a high fall, the loss is much less. It may be assumed that over 80 per cent. of the theoretical power can be made available for mechanical use and about 70 per cent. can be transformed into electrical energy capable of being applied either to mechanical or chemical purposes, or for producing light or heat.

There is no way that can be seen at present of utilizing the power of falling rain-drops, and all that can be done is to make use of the water as it passes from a higher to a lower part of the land surface. The easiest way to do this is at a waterfall where a stream falls over a vertical rock. The waterfall itself is not usually led into the machinery; but water diverted from above the fall is led into a shaft provided with an outlet below the fall, the power station being built either on the higher or the lower level as may be more convenient. Or in cases where there is no actual waterfall water may be led from the upper part of the stream by a new channel to a place where a vertical fall can be provided, or it may be led in a strong pipe down a slope where no vertical fall can be provided and utilized farther down by taking advantage of the pressure in the pipe caused by the head of water. In many cases where only a little power is required, as for lighting a house or a village, the natural flow of the stream suffices, the smallest flow of the driest weather being enough to yield the power required.

(*To be continued.*)

THE WEATHER OF AUGUST, SEPTEMBER AND OCTOBER.

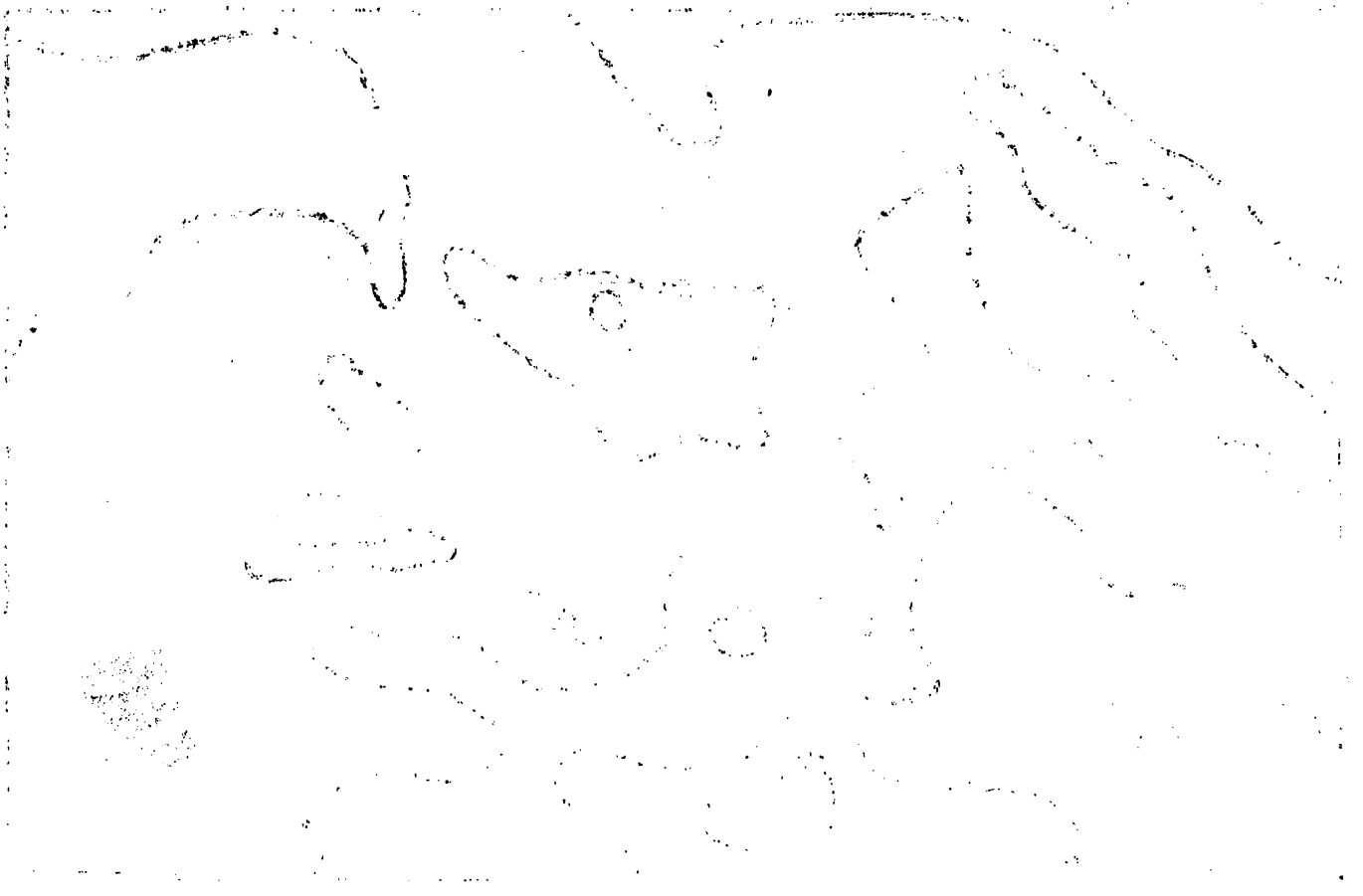
By F. J. Brodie.

The following brief summaries of the weather during the three months in question serve to bridge over the gap due to the recent suppression of meteorological information :—

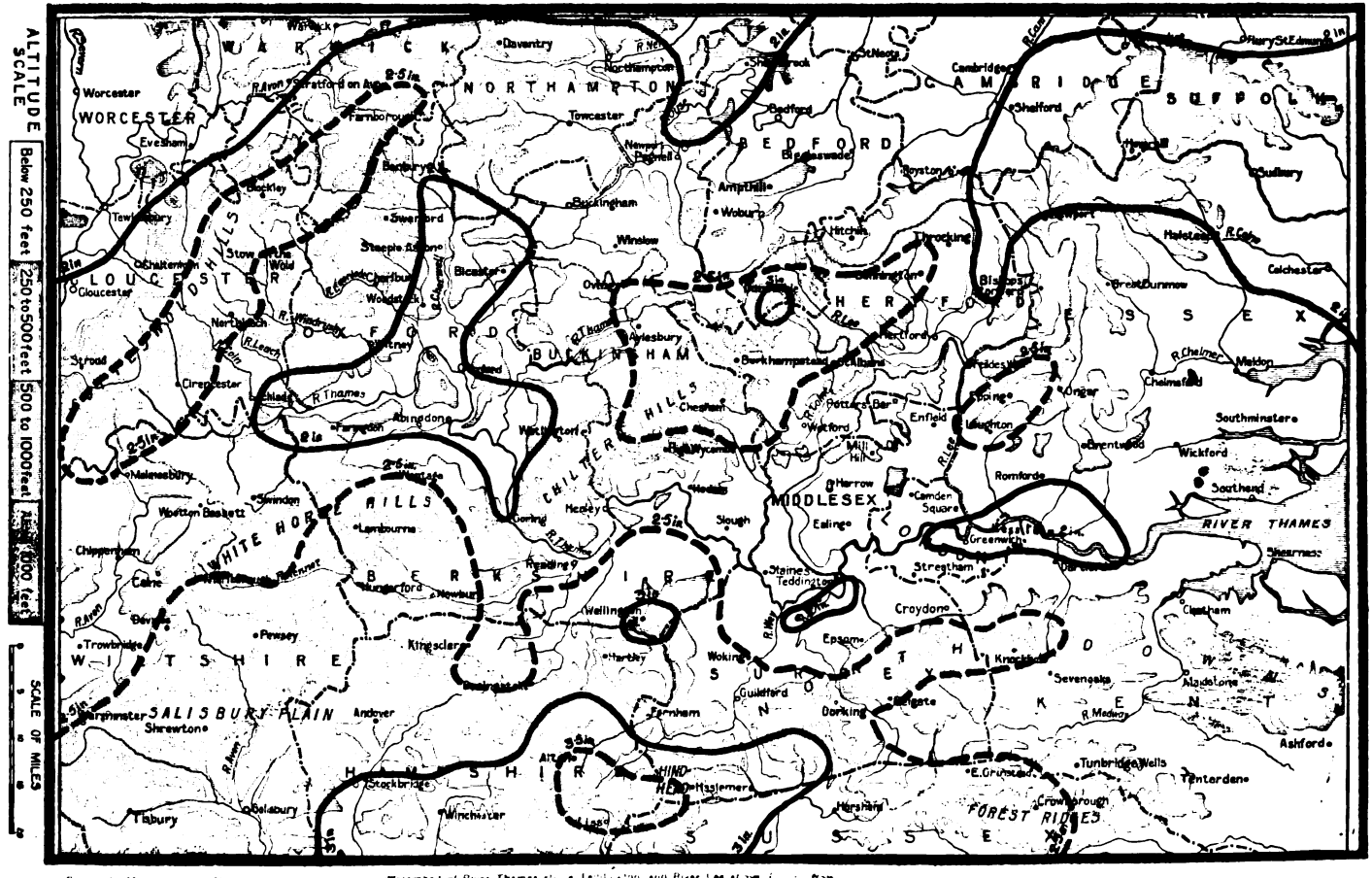
August.—Over the greater part of England the opening and closing weeks of August were rainy and unsettled. During the remainder of the month the weather was fine and sunny, and eminently favourable for the progress of the harvest. Temperature, which was, as a rule, above the average, reached its culminating point on the 22nd, when shade readings ranging between 85° and 90° were recorded over a large portion of the eastern, midland and southern counties; at Canterbury the thermometer rose to 93°. The weather was at the time under the influence of southerly winds blowing in the front of a shallow cyclonic system which was advancing from the Atlantic. Next day, when the disturbance passed away to the eastward, the wind shifted to north, and an unusually rapid fall of temperature occurred. In Ireland and Scotland changeable showery weather prevailed throughout nearly the whole month. The mean temperature of August was everywhere above the average, but the duration of bright sunshine showed an excess only in the eastern parts of England; in most of the western districts there was a large deficiency. Thunderstorms were somewhat rare for the time of year.

September.—In addition to its extraordinarily heavy rainfall (to which full reference is made on p. 103) the month was characterised by an abnormally low temperature. In Scotland it appears to have been the coldest September for at least sixty years. Between the 5th and 7th the thermometer rose a little above 70° in many parts of the United Kingdom and touched 75° at Manchester. At most other times the daily maxima were below 60°, and on the 29th there were many places in which the thermometer failed to reach 50°. Accompanying the frequent passage of cyclonic disturbances across the more northern districts the prevailing winds were westerly, and often very strong in force, with occasional gales on our western coasts. The mean temperature of the month was below the average, especially in the north. In Wales and the neighbouring English counties bright sunshine was very deficient, but in other parts of the Kingdom it was equal to, or slightly above, the average. Thunderstorms were unusually frequent, more especially in the earlier half of the month.

October, although not particularly wet, was for the most part dull, damp and cheerless. The opening week was also very stormy, the passage of deep depressions outside our western and northern coasts being marked by southerly and south-westerly gales of considerable severity. At Quilty (co. Clare) the wind on the 7th reached, in gusts, a velocity of 39 metres per second, or 85 miles per hour. The highest temperatures were recorded mostly around the 6th or the 10th, when the thermometer rose to 65°, or a trifle above it, at a number of places situated in nearly all parts of the country. Sharp touches of frost occurred from time to time in most districts; on the surface of the grass several places experienced a ground frost on at least ten or a dozen nights, and at Hemel Hempstead on as many as fourteen nights. In the latter part of the month a good deal of wet fog prevailed over England and yielded in many instances perceptible quantities of water in the rain gauges. The mean temperature of the month was a trifle below the average, and the aggregate amount of bright sunshine was generally very deficient, few districts experiencing as much as one-fourth of the possible duration.



THAMES VALLEY RAINFALL. NOVEMBER, 1918.



Symons's Meteorological Magazine

THE WEATHER OF NOVEMBER.

THE month opened with a week of mild cyclonic weather, and on the 2nd, the 5th and the 7th—8th, deep depressions moving over adjacent regions of the Atlantic caused strong gales from between south and west on many parts of our coasts. On the 2nd and again on the 7th and 8th, the wind rose in gusts to a velocity of 70 miles an hour and upwards at many places in the west and north, and on the 2nd reached a velocity of 78 miles an hour at Falmouth (Pendennis Castle). The highest temperatures were recorded, as a rule, on the 1st or 2nd, when the thermometer rose to 55° and upwards in most districts, and touched 60° at Holyhead. Between the nights of the 5th and 7th lightning was seen off the west coast of Scotland, and the north coast of Ireland.

After about the 9th a large anticyclone of considerable intensity appeared over the United Kingdom and remained in force until about the 20th. In many parts of the country no measurable quantity of rain fell for at least ten or twelve days, and in some few places the minimum limit of an absolute drought (fifteen consecutive rainless days) was attained. Over eastern and Central England, however, there was much fog during the night and early morning hours, and in several instances the air was sufficiently humid to deposit appreciable quantities of water in the rain gauges. Towards the middle of the anti-cyclonic spell the weather became very cold, and sharp night frosts were experienced. In many places the thermometer between the 17th and 19th failed to reach 40°, and at Glasgow on the former date it did not get above the freezing point. At night the thermometer in the screen fell below 25° at stations, a reading as low as 14° being reported at Eskdalemuir on the 20th. On the surface of the grass frost was unusually prevalent; at Kew, Aberdeen and Dublin it occurred on nineteen nights, and at Benson on as many as twenty-one nights. Towards the close of the month the anticyclone passed away to the westward, and mild southerly winds and unsettled rainy weather set in over the entire kingdom. Owing, however, to the long spell of cold which had previously been experienced the mean temperature of the month was everywhere below the average.

One of the most striking features in the weather of November was the prevalence of fog, more especially over the eastern and midland counties. Records made during the 20 years ended 1915 show that in an average November not more than 3 or 4 days are affected by this disagreeable visitant. Last month many places reported fog on at least 8 or 9 days. At Tynemouth it occurred on as many as 15 days. the number being more than four times the average, and twice as large as in any November of the previous 22 years.

The total duration of bright sunshine last month was, as a rule, not widely different from the normal; at the majority of stations there appears to have been a slight excess.

The distribution of total rainfall was normal, and no great departures from the average were observed. England had a rainfall slightly in defect nearly everywhere with less than 2 inches over the north midlands and north-east. More than 3 inches fell in patches in the south and south-west, and over part of the Pennines, but more than 6 inches was very local. Wales had more than the average in the west, and Scotland everywhere except in the north and north-east, and more than 10 inches fell widely in the west Highlands. Ireland was dry in the south and wetter in the north, more than 4 inches falling generally over the north-western half. The general rainfall for the countries, expressed as a percentage of the average, was :—England and Wales, 79; Scotland, 105; Ireland, 102; British Isles, 95.

In London (Camden Square) the mean temperature was 42°·9, or 0°·6 below the average for 50 years. The duration of bright sunshine was 22·3 hours, and the duration of rainfall, 63·3 hours. Evaporation, ·24 in.

RAINFALL TABLE FOR NOVEMBER, 1918.

STATION.	COUNTY.	RAINFALL. Aver. 1875–1909. in.	1918. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	Nos. of Day
Camden Square	*London*	2·34	2·21	— ·13	94	·52	3	16
Tenterden	*Kent*	3·07	2·39	— ·68	78	·68	4	14
Arundel (Patching)	*Sussex*	3·54	2·00	—1·54	56	·54	4	11
Fordingbridge (Oaklands)	*Hampshire*	3·41	3·14	— ·27	92	1·11	4	17
Oxford (Magdalen College)	*Oxfordshire*	2·25	1·94	— ·31	86	·47	4	13
Wellingborough (Swanspool)	*Northampn*	2·22	1·94	— ·28	87	·46	3	14
Bury St. Edmunds (Westley)	*Suffolk*	2·40	2·10	— ·30	88	·95	3	14
Geldeston [Beccles]	*Norfolk*	2·49	1·42	—1·07	57	·61	3	15
Polapit Tamar [Launceston]	*Devon*	4·07	4·28	+ ·21	105	1·24	1	18
Rousdon [Lyme Regis]	,,	3·51	2·42	—1·09	69	·61	4	13
Stroud (Field Place)	*Gloucester*	2·77	2·19	— ·58	79	·74	5	11
Church Stretton (Wolstaston)	*Shropshire*	2·94	1·55	—1·39	53	·50	4	11
Boston	*Lincoln*	2·05	2·11	+ ·06	103	·78	3	15
Worksop (Hodsock Priory)	*Nottingham*	1·98	1·40	— ·58	71	·32	3, 4	13
Mickleover Manor	*Derbyshire*	2·21	1·74	— ·47	79	·34	4	13
Congleton (Buglawton Vic.)	*Cheshire*	2·61	2·06	— ·55	79	·63	28	15
Southport (Hesketh Park)	*Lancashire*	3·16	1·97	—1·19	62	·32	30	15
Wetherby (Ribston Hall)	*York, W.R.*	2·34	1·56	— ·78	67	·29	4	7
Hull (Pearson Park)	,, *E.R.*	2·34	1·51	— ·83	65	·45	3	11
Newcastle (Town Moor)	*North'land*	2·63	1·46	—1·17	56	·30	1	15
Borrowdale (Seathwaite)	*Cumberland*	13·59	10·51	—3·08	77	...	...	...
Cardiff (Ely)	*Glamorgan*	4·08	3·27	— ·81	80	1·01	4	18
Haverfordwest	*Pembroke*	5·16	5·25	+ ·09	102	1·40	1	16
Aberystwyth (Gogerddan)	*Cardigan*	4·50	4·61	+ ·11	102	1·05	10	17
Llandudno	*Carnarvon*	3·19	1·80	—1·39	56	·38	28	12
Cargen [Dumfries]	*Kirkcudbrt.*	4·35	4·62	+ ·27	106	1·00	4	14
Marchmont House	*Berwick*	3·21	*1·32*	—1·89	41	...	...	...
Girvan (Pinmore)	*Ayr*	5·24	6·08	+ ·84	116	1·20	5	18
Glasgow (Queen's Park)	*Renfrew*	3·63	3·58	— ·05	99	·62	5	19
Islay (Eallabus)	*Argyll*	5·33	6·99	+1·66	130	1·16	4	19
Mull (Quinish)	,,	6·24	7·58	+1·34	121	2·01	7	20
Balquhidder (Stronvar)	*Perth*	7·87	9·49	+1·62	121	1·80	9	17
Dundee (Eastern Necropolis)	*Forfar*	2·62	1·63	— ·99	62	·50	1	20
Braemar	*Aberdeen*	3·76	3·41	— ·35	91	1·32	1	10
Aberdeen (Cranford)	,,	3·29	1·99	—1·30	61	·75	4	10
Gordon Castle	*Moray*	2·85	...	...	...	...	...	...
Drumnadrochit	*Inverness*	3·41	3·72	+ ·31	109	1·25	4	15
Fort William	,,	7·55	8·95	+1·40	119	1·42	9	19
Loch Torridon (Bendamph)	*Ross*	8·90	7·74	—1·16	87	1·31	6	17
Dunrobin Castle	*Sutherland*	3·25	3·17	— ·08	98	1·22	4	10
Glanmire (Lota Lodge)	*Cork*	4·45	3·11	—1·34	70	·85	7	16
Killarney (District Asylum)	*Kerry*	5·54	4·52	—1·02	82	1·06	1	20
Waterford (Brook Lodge)	*Waterford*	3·80	3·46	— 34	91	1·07	1	15
Nenagh (Castle Lough)	*Tipperary*	3·88	3·54	— ·34	91	·97	1	16
Ennistymon House	*Clare*	4·62	4·21	— ·41	91	·60	27	19
Gorey (Courtown House)	*Wexford*	3·41	3·50	+ ·09	103	·68	7	14
Abbey Leix (Blandsfort)	*Queen's Co.*	3·28	3·02	— ·26	92	·90	1	17
Dublin (Fitz William Square)	*Dublin*	2·64	2·52	— ·12	95	1·20	1	14
Mullingar (Belvedere)	*Westmeath*	3·38	3·72	+ ·34	111	·73	4	16
Crossmolina (Enniscoe)	*Mayo*	5·75	6·48	+ ·73	112	1·40	1	19
Cong (The Glebe)	,,	5·00	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	4·02	4·62	+ ·60	115	·78	4	20
Seaforde	*Down*	3·86	4·58	+ ·72	122	1·42	1	17
Ballymena (Harryville)	*Antrim*	3·95	5·69	+1·74	144	1·79	4	21
Omagh (Edenfel)	*Tyrone*	3·66	4·15	+ ·49	113	1·15	4	19

SUPPLEMENTARY RAINFALL, NOVEMBER, 1918.

Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	2·72
,,	Ramsgate	2·20
,,	Hailsham	2·58
,,	Totland Bay, Aston House...	2·47
,,	Stockbridge, Ashley..	3·31
,,	Grayshott	3·87
III.	Harrow Weald, Hill House...	2·20
,,	Pitsford, Sedgebrook....	...
,,	Woburn, Milton Bryant.....	...
,,	Chatteris, The Priory..... ...	2·08
IV.	Elsenham, Gaunts End	2·10
,,	Shoeburyness	2·34
,,	Colchester, Hill Ho., Lexden	1·91
,,	Ipswich, Rookwood, Copdock	1·86
,,	Aylsham, Rippon Hall	2·00
,,	Swaffham	2·00
V.	Bishops Cannings	2·81
,,	Weymouth..... ...	2·28
,,	Ashburton, Druid House.. ...	5·51
,,	Cullompton	3·01
,,	Lynmouth, Rock House	4·66
,,	Okehampton, Oaklands... ...	3·97
,,	Hartland Abbey.....	3·27
,,	St. Austell, Trevarna	4·63
,,	North Cadbury Rectory... ..	2·54
VI.	Clifton, Stoke Bishop	2·05
,,	Ledbury, Underdown..... ...	1·86
,,	Shifnal, Hatton Grange.....	1·61
,,	Droitwich.....	1·74
,,	Blockley, Upton Wold.....	2·71
VII.	Grantham, Saltersford.....	1·96
,,	Louth Westgate	1·92
,,	Bawtry, Hesley Hall	1·15
,,	Whaley Bridge, Mosley Hall	2·71
,,	Derby, Midland Railway.....	1·39
VIII.	Nantwich, Dorfold Hall	2·11
,,	Bolton, Queen's Park	3·09
,,	Lancaster, Strathspey	2·55
IX.	Langsett Moor, Up. Midhope	1·48
,,	Scarborough, Scalby	1·35
,,	Ingleby Greenhow	1·86
,,	Mickleton	2·40
X.	Bellingham, High Green Manor	1·74
,,	Ilderton, Lilburn Cottage ...	1·35
,,	Keswick, The Bank.....	5·74
XI.	Llanfrechfa Grange	3·21
,,	Treherbert, Tyn-y-waun	8·87
,,	Carmarthen, The Friary	4·28
,,	Fishguard, Goodwick Station.	8·82
,,	Crickhowell, Tal-y-maes.....	2·50
,,	Gwern-y-argllwydd	2·50
,,	Birmingham WW., Tyrmynydd	4·55
,,	Lake Vyrnwy	3·77
,,	Llangynhafal, Plas Drâw.....	2·13
,,	Rhiwbryfdir	7·15
,,	Dolgelly, Bryntirion.....	6·64
XI.	Lligwy	2·58
,,	Douglas, Isle of Man	4·33
XII.	Stoneykirk, Ardwell House...	3·72
,,	Carsphairn, Shiel.....	9·37
,,	Langholm, Drove Road	3·64
XIII.	Selkirk, The Hangingshaw..	2·94
,,	North Berwick Reservoir.....	1·35
,,	Edinburgh, Royal Observaty.	1·31
XIV.	Biggar.....	3·46
,,	Maybole, Knockdon Farm ...	5·06
XV.	Buchlyvie, The Manse.....	5·68
,,	Ardgour House	12·37
,,	Oban.....	7·04
,,	Campbeltown, Witchburn ..	...
,,	Holy Loch, Ardnadam.....	10·56
,,	Tiree, Cornaigmore	...
XVI.	Glenquey	3·30
,,	Loch Rannoch, Dall	7·27
,,	Blair Atholl	3·25
,,	Coupar Angus	1·65
,,	Montrose, Sunnyside Asylum.	1·85
XVII.	Balmoral	2·98
,,	Fyvie Castle	1·05
,,	Keith Station	2·30
XVIII.	Rothiemurchus	...
,,	Loch Quoich, Loan	22·60
,,	Skye, Dunvegan	7·73
,,	Fortrose.....	2·13
,,	Glencarron Lodge	6·59
XIX.	Tongue Manse	2·47
,,	Melvich	3·10
,,	Loch More, Achfary	5·21
XX.	Dunmanway, The Rectory ..	5·17
,,	Mitchelstown Castle.....	3·02
,,	Gearahameen	8·00
,,	Darrynane Abbey.....	5·69
,,	Clonmel, Bruce Villa	3·07
,,	Broadford, Hurdlestown.....	3·73
XXI.	Enniscorthy, Ballyhyland...	4·27
,,	Rathnew, Clonmannon	2·65
,,	Ballycumber, Moorock Lodge	2·96
,,	Balbriggan, Ardgillan	2·27
,,	Castle Forbes Gardens.....	3·76
XXII.	Ballynahinch Castle.....	7·38
,,	Woodlawn	3·77
,,	Westport House	6·25
,,	Dugort, Slievemore Hotel ...	6·20
XXIII.	Enniskillen, Portora.....	4·41
,,	Dartrey [Cootehill]	4·09
,,	Warrenpoint, Manor House ..	3·27
,,	Belfast, Cave Hill Road	5·25
,,	Glenarm Castle	5·62
,,	Londonderry, Creggan Res...	3·84
,,	Milford, The Manse.....	4·19
,,	Killybegs	7·18

Climatological Table for the British Empire, June, 1918.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°		°	°	inches		
London, Camden Square	83·2	2	41·0	17	71·2	48·3	48·5	67	30·4	39·0	1·30	11	5·9
Malta	89·7	29	61·2	1	75·9	65·0	...	65	137·0	57·0	·16	3	1·9
Lagos	93·0	10	70·1	2	83·5	73·5	72·3	82	147·0	68·1	18·13	21	8·2
Cape Town ..	74·9	6	39·4	15	62·8	48·5	50·5	82	...	...	4·80	13	6·9
Johannesburg	65·3	14	30·9	23	61·1	41·4	32·8	58	...	29·9	·02	2	1·3
Mauritius	77·3	2	57·0	...	74·9	62·3	61·0	79	...	51·0	2·66	26	5·6
Bloemfontein	67·2	25a	21·2	28	62·4	31·5	30·4	62	...	...	·00	0	3·1
Calcutta	95·0	5	74·6	18	87·5	77·7	77·5	89	...	73·1	16·99	21	9·2
Madras	102·3	9	72·3	15	98·2	79·2	71·1	56	155·2	73·3	1·80	10	5·2
Colombo, Ceylon ..	87·1	7	73·1	17	85·8	77·9	73·7	80	156·1	71·3	5·04	21	7·2
Hongkong	99·9	29	72·8	17	83·6	76·5	74·7	86	...	...	24·80	22	8·0
Sydney	72·3	15	41·3	29	65·2	46·6	43·8	73	114·7	32·9	·55	4	2·6
Melbourne	65·2	2	40·2	30	57·8	46·8	44·4	74	106·2	30·3	1·76	16	6·8
Adelaide	66·9	2	36·0	8	62·1	47·9	47·8	78	121·0	29·0	2·71	15	...
Perth	74·0	1	43·1	28	65·4	53·3	51·8	78	127·6	57·0	10·50	27	7·0
Coolgardie	75·2	1	30·2	28	63·1	44·4	44·1	68	128·0	25·5	1·67	6	5·8
Brisbane	86·9	19	38·5	29	72·7	47·8	47·2	62	136·0	34·6	·20	3	2·5
Hobart, Tasmania ..	59·0	24	33·2	8	53·3	41·0	38·8	71	102·6	31·1	1·97	16	5·8
Wellington ...	61·9	3	32·9	30	56·1	44·8	44·5	79	120·0	20·8	7·08	16	6·1
Jamaica, Kingston ..	92·0	28	69·6	25	87·6	72·8	70·8	78	...	...	·84	8	4·2
Grenada	86·0	8	70·0	11b	83·0	73·0	...	77	136·0	...	11·26	21	4·6
Toronto	86·3	1	39·0	8	71·6	51·4	49·0	69	140·0	34·0	3·35	13	4·9
Fredericton	86·5	2	33·0	21	69·2	45·4	48·6	68	...	...	4·48	7	5·1
St. John, N.B. ...	80·5	3	40·3	19	62·8	46·4	46·5	76	135·4	35·0	4·48	11	5·7
Victoria, B.C.	79·5	5	41·9	2	66·4	49·4	46·0	69	138·0	33·2	·33	3	3·4

a—26. b—17

Johannesburg.—Bright sunshine 278·1 hours.

COLOMBO, CEYLON.—Mean temp. 81°·8, or 0°·1 above, dew point 1°·0 below, and R 2·61 in. below, averages. Mean hourly velocity of wind 5·8 miles.

HONGKONG.—Mean temp. 79°·5. Bright sunshine 147·6 hours. Mean hourly velocity of wind 7·6 miles.

Sydney.—The highest mean max. temp. on record for June.

Melbourne.—Temperature low with mild winter and almost complete absence of frosts.

Adelaide.—Mean temp. 1°·6 above, and R ·39 in. below, averages.

Perth.—Rainfall 3·67 in. above average.

Coolgardie.—Temp. 1°·2 above, and R about ·50 in. above, averages.

Brisbane.—Rainfall 2·39 in. below average. Frost on 8 days.

Wellington.—Mean temp. 1°·0 above, and R 2·06 in. above, averages. Bright sunshine, 110·6 hours. Frost on 11 days.

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THE RAINFALL OF 1918.

By Carle Salter.

At the time of writing it is not possible to give more than a preliminary survey of the broader features of the rainfall distribution during 1918, based upon a selection from the 3,000 returns so far received. In doing so we follow the usual practice of comparing the total fall with the average of the 35 years 1875-1909. The general values are computed by taking the mean of a number of records distributed as equally as possible over the country.

The following table gives in summary form the general percentage values for each month :—

	England & Wales.	Scotland.	Ireland.	British Isles.		England & Wales.	Scotland.	Ireland.	British Isles.
January ..	123	104	110	113	July ...	146	141	126	140
February ...	107	154	166	140	August ...	74	103	83	85
March ...	62	48	65	58	September	247	150	209	207
April ...	106	49	56	74	October ...	71	124	123	100
May	113	94	91	100	November	79	105	102	95
June	51	77	61	61	December	153	98	139	132

The outstanding feature of the year was the very unusual wetness of September, which was undoubtedly the most rainy since that of 1896. The wet February and July were also notable, but the spring and early summer were, generally speaking, dry, particularly in Scotland and Ireland, and, after September, the autumn months, although marked by lack of sunshine and prevalence of damp, foggy weather, were normal in regard to total rainfall. December was also damp and exceptionally mild, but with more rainfall generally.

The total rainfall for the year was nearly everywhere in excess of the average, the exceptions being the east of Scotland, the extreme north-east of England, part of the Midlands, and a narrow strip extending along nearly the whole of the south coast of England. There were very slight deficiencies at one or two stations in the east of Ireland. The deficiency was greater than 10 per cent. from Aberdeenshire to Northumberland, including part of the area in eastern Perthshire where the deficiency was more than 20 per cent. in 1917.

The areas over which the rainfall exceeded the average by more than 10 per cent. group themselves into three wide and roughly

parallel bands running from south-west to north-east. The most westerly of these appears to have stretched unbroken from Co. Cork to Caithness. The only parts of this long strip with more than 20 per cent. excess seem to have been in Clare and Tipperary. A central and wider strip with more than 10 per cent. excess extended from north Cornwall and from Waterford to Scarborough and Glasgow, and embraced practically the whole of Wales and the Pennines. Considerable areas with more than 20 per cent. excess lay in North Wales, Lancashire, Yorkshire and the English Lake District, and one or two stations had as much as 30 per cent. more than the average. A third strip with excessive rainfall stretched with some breaks from Sussex to Norfolk. In this area there were no very remarkable departures from the average.

Summing up the rainfall of the larger divisions of the country in general values we find that in England the total for the year was 7 per cent. above the average, in Wales, 18 per cent., in Scotland, 6 per cent., and in Ireland, 11 per cent. For the British Isles as a whole there was an excess of 9 per cent.

CONGRESS OF SCANDINAVIAN GEOPHYSICISTS IN GOTHENBURG, AUGUST 28th—31st, 1918.

By Dr. Hans Pettersson.

At the invitation of Dr. G. Ekman, Prof. O Nordenskjöld, Prof. O. Pettersson and other scientists of Gothenburg, Sweden, a highly representative congress of about fifty Danish, Norwegian and Swedish geophysicists met in that city during the latter part of August, 1918. Representatives from Finland had also been invited, but were unable to be present.

At a public meeting, on August 28th, the Congress was opened by the representative of the King of Sweden. Prof. Hildebrandsson, of Upsala, was unanimously elected president supported by three vice-presidents, *viz.*, Director Ryden (Denmark), Prof. Bjerknes (Norway), and Prof. Nordenskjöld (Sweden); General Secretary, Dr. Hans Pettersson.

At the first general meeting which was open to the public, three papers were read. (i.) By Prof. Bjerknes, of Bergen, on "Weather Forecasting," describing a new and most successful method of short range prognostics for agricultural purposes established in West Norway during the summer of 1918, based on synoptic observations, especially of the wind, from a large number of meteorological stations along the west coast of Norway, the percentage of correct forecasts having been between eighty-five and ninety. (ii.) Prof. Knudsen, of Copenhagen, read a paper on "Hydrographical observations on the west coast on Greenland by the late Dr. T.

Wulff." (iii.) Prof. Arrhenius, of Stockholm, read a paper on "Some observations of the Aurora Borealis."

During the following days general and sectional meetings were held. In all thirty papers were read, many of these being of very great interest. One afternoon was devoted to the phenomena of the Aurora Borealis, a forenoon to weather forecasting, and the last afternoon was occupied by very animated discussions regarding future Scandinavian co-operation in different branches of geophysical science. Finally resolutions were moved and adopted by the Congress *in pleno*, and a committee formed with the object of calling together a second Congress in due course.

A publication, giving abstracts of the papers read before the Congress, and the resolutions adopted, will shortly be published.

Among the papers read were the following :—

August 28th :—Prof. Vegard (Christiania), "Results from observations of the Aurora Borealis, at Haldde"; Prof. Störmer (Christiania), "Photographic altitude measurements of the Aurora Borealis in Christiania, 1917 and 1918"; Dr. Stenqvist (Stockholm), "On the desirability of making observations of the polarization of diffuse daylight, especially in North Scandinavia"; Dr. K. Modin (Stockholm), "Observations of the Aurora Borealis in Sweden since 1881."

August 29th :—Prof. De Geer (Stockholm), "On a possible method of estimating post-tertiary solar activity"; Prof. Helland-Hansen (Bergen), "Investigations of surface-temperatures in the North Atlantic and their prognostic value"; Dr. A. Wallén (Stockholm), "Forecasting the flow of water in rivers"; Prof. Hesselberg (Christiania), "Turbulent motion in the atmosphere"; Dr. Wallén (Stockholm), "Atmospheric precipitation as dependent on the wind, the altitude and the geographical situation in south Sweden"; Dr. Sandström (Stockholm), "The distribution of atmospheric pressure and its causes"; Dr. Angström (Upsala), on "Temperature variations in the upper strata and their relationship with atmospheric transmission and solar activity"; Dr. Sondén (Stockholm), "Hygienic importance of vertical circulation"; Dr. Gaarder (Bergen), "Influence of the atmospheric variations over North Europe on hydrographic changes in the Christianiafjord"; Dr. Hans Pettersson (Gothenburg), "Vertical movements in the sea on the west coast of Sweden."

August 30th :—Dr. Wallén (Stockholm), "On the run-off and evaporation in the Lagan valley"; Dr. Sandström (Stockholm), "Weather forecasting for airmen"; Captain Wallgren (Stockholm), "Local weather forecasting according to simple observations"; Prof. Hamberg (Upsala), "Movements of the ice on Lake Sommen in February and March, 1918."

The afternoon of the 30th was devoted to an excursion to the Trollhättan waterfalls.

August 31st :—Prof. O. Pettersson, "Cosmic influences on the internal movements in the sea and the atmosphere"; Dr. Ahlmann and Dr. Sandström, "Geophysical studies in West Norway"; Prof. Hesselberg (Christiania), "Scandinavian co-operation in aërological science"; Prof. Helland-Hansen (Bergen), "Scandinavian co-operation in geophysical science."

Resolutions adopted by the Congress.

I.—In favour of an extension of the existing system of simultaneous photographic altitude measurements of the Aurora Borealis started by Prof. Störmer to comprise the whole of Scandinavia during the winter, 1918-19. (Moved by Prof. Störmer, of Christiania).

II.—In favour of the plan proposed by Prof. De Gerr, that measurements of the yearly deposits of loam occurring in lakes blocked by ice, and in shallow bights, which derive from the melting o Scandinavian and Arctic glaciers, should be carried out in conf nection with De Geer's geochronological measurements of the annual-striæ in post-tertiary deposits of similar origin. (Moved by Prof. De Geer.)

III.—In favour of establishing a system of continuous synoptic observations of the internal movements in the sea round the coasts of Scandinavia compared with simultaneous meteorological phenomena and fishery statistics. (Moved by Dr. Hans Pettersson, Sweden, and others.)

IV.—In favour of the establishment of ærological observations in different parts of Scandinavia. (Moved by Prof. Hesselberg, Christiania.)

V.—Emphasizing the need for co-operation between the geophysicists of the Scandinavian countries, both with regard to laboratory and field research, which proposal the governments of these countries are requested to facilitate as much as possible.

VI.—In favour of the project that a first-class scientific institute shall be established in Gothenburg for oceanography, marine meteorology and aerology, with the object of studying the dynamics of the movements occurring in the atmosphere and the sea, which determine the climate and the weather of the Scandinavian countries, and of studying the influence of these factors on agriculture, fisheries, navigation and aëronautics. (Moved by Prof. O. Pettersson and seconded by ten representatives for Denmark, Sweden and Norway.)

WORK AND WATER POWER.

By Hugh Robert Mill.

(*concluded.*)

Whenever the full benefit of the natural water-power is wanted, nature must be assisted by some method of storage so that a uniform flow of water can be maintained either during normal working hours or throughout the twenty-four hours of every day in the year. Here the professional skill of the water-engineer is necessary before the mechanical or electrical engineer can make use of the natural power, and the water-engineer has to depend on certain natural laws and relationships which have been worked out by the scientific study of the results obtained by Observers of rainfall.

Let us suppose that there is a lake situated in a valley 500 feet above sea-level, with 50 square miles of land draining into it and a river flowing out by a steep course to the sea. An engineer on examining the district has fixed upon a site for a power-station at which 400 feet of fall can be utilized, and he proposes to build a dam across the outlet of the lake in order to raise its level and increase the storage of water so that he can draw off a uniform supply for the turbines at the power-station. Before he can decide on the amount of storage required or on the power which will be available he must know the average annual rainfall on the ground—this is necessary because it would take many years to measure the fluctuations in the flow of the stream. I have explained in some detail the way in which the rainfall of a gathering ground can be ascertained in a paper on "The Rainfall of the Forth Valley and the Construction of a Rainfall Map," in *British Rainfall, 1915*, to which the reader is referred for the manner of ascertaining the average rainfall of an area. It depends, of course, on long-continued records of rainfall, but the important fact, and one which is not generally realized, is that such records need not all be upon the area in question. Observations in contiguous, and sometimes even in rather remote areas, are necessary in order to give certainty as to the general distribution of rain over the country-side of which the gathering ground forms part. In this way the daily readings of a rain gauge in a little cottage garden may provide the essential data for determining the value of a water-power many miles away. Let us suppose that the general rainfall is 60 inches over the gathering ground for an average of 35 years. Experience has shown that the mean annual rainfall of the three driest years likely to occur consecutively is 80 per cent. of the average, and engineers have adopted this figure in calculating the water available in any gathering ground. A certain part of the annual rainfall is lost by evaporation from the surface, transpiration through vegetation and percolation into the ground. For this loss an amount

equal to from 12 to 16 inches of rainfall is usually allowed, according to local conditions, and for our purpose we may take it as 14 inches. The available rainfall from our hypothetical area is thus 80 per cent. of 60 inches, less 14 inches; that is to say, 34 inches per annum. In the case of water taken for the supply of distant towns Parliament usually requires that from one-quarter to one-third of the available rainfall shall be returned to the streams by way of compensation for the water abstracted; but in power works, where the water may be diverted from the stream for only a short distance, no definite practice has yet been established, and, for the present, compensation water may be ignored.

Now 34 inches over 50 square miles is 1,700 square-mile-inches, and 1 square-mile-inch in a year is equivalent to very nearly 40,000 gallons per day, the whole available volume of water on the area would be 68 million gallons, or 680,000,000 lbs, in a day, or 472,000 lbs. per minute, day and night throughout the year. With an effective fall of 400 feet, as assumed, this would equal 188,800,000 foot-pounds per minute, or 5,721 horse-power, which, with 70 per cent. efficiency of the turbines and dynamos, would correspond to 4,000 electric horse-power, or 2,984 kilowatts continuously developed.

The work done by water falling down hill, is, as in the case of the bottle-smashing illustration, with which this article began, the exact equivalent of the work done in carrying the water up-hill to begin with. And since in our country water is always falling down-hill day and night all the year round, water to the same amount must be being carried up-hill all the time. It is carried through the air in the form of vapour mainly from the surface of the sea probably at great distances from the land, and it is all raised by the action of heat, the heat of the sun acting it may be as far away as the tropical ocean. However, it comes there we know with absolute certainty that every gallon of water dropped from the clouds on the top of Ben Nevis has required the expenditure of at least 44,000 foot-pounds of work to bring it there, and this is altogether independent of the heat required to change the water from the liquid to the gaseous state, or to move it horizontally against the friction of the air. It follows that the fall of the gallon of water from the top of Ben Nevis to the sea would, if it could all be utilized, produce 44,000 foot-pounds of work which could by appropriate means be transformed into an equivalent amount of any other form of energy. Hence, if we look on falling water as the weight which drives a clock, the heat of the sun is the hand that winds it up. As the winding up by the sun never ceases so the falling of water is a source of power which is always renewed.

Fuel as a vehicle of energy is equally a result of solar radiation, though in this case it is a slow business, for much time is required for the leaves of a plant to store up the carbon and hydrogen which

the sun's light separates from the oxygen of carbonic acid gas and water, and an enormously greater time for vegetable matter to assume the density of coal. A very short time, indeed, suffices to re-unite the carbon and hydrogen with the oxygen of the air, hence mineral fuel as a source of energy can be exhausted if used to its full available extent, while water-power is renewed to its full extent for ever as long as the sun continues to shine. Burning coal is like living on capital, harnessing water-power is like living on income; but the source of capital, which is only saved income, and of current income alike is the sun.

There is a tendency for people to whom the value of water power is a new idea to exaggerate its utility. As compared with coal or other fuel water-power labours under the disadvantage that it can only be generated in places where the necessary fall can be obtained. Although electrical energy can be transmitted for 200 miles or more from the place where it is generated by water-power long transmission lines are very costly, and they may only be economically possible in cases where water-power can be utilized very cheaply and where the alternative use of fuel is very costly. In this country it may be said roughly that the proportion of the natural water-power which it would pay to utilize depends on the price of coal. As the cost of fuel rises it becomes worth while to draw on sources of water-power, which from remoteness, or cost of works, could never pay while coal is cheap.

The utilization of tidal power is quite different in character, for though water is the medium the work obtained from it through the tide-raising power of gravitation is taken not from solar heat but from the rotation of the Earth itself. In the long run a full utilization of tidal power would make the Earth rotate more slowly and increase the length of the day, although by an amount too slight to be perceptible in the probable duration of human existence.

METEOROLOGICAL NEWS AND NOTES.

Phenological Observers, Royal Meteorological Society.—Fresh helpers would be greatly valued especially in the less populous regions in the west and north of Great Britain and in all parts of Ireland. Forms and a sample copy of the annual report will be gladly sent by the Assistant Secretary, 70, Victoria Street, S.W.1.

Mr. H. E. Carter, chief computer to the British Rainfall Organization, has, we are glad to report, returned from Germany, where he had been confined as a prisoner of war since March, 1918. He took up his duties in the Office of the Organization again on January 1st, 1919.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

WEATHER CONDITIONS ILLUSTRATED BY FLOWER PHENOLOGY.

My local flower counts for (*a.*) December, and (*b.*) the Christmas to New Year period, aim at determining the characteristics of the transition period from the old phenological season to the new. The former values (*a*) illustrate primarily the lingering on from the old, secondarily the amount of pre-seasonal stimulation for the new season by the number of flowers reasonably assignable to the same. The latter values (*b.*) indicate the extent of December influences in destroying the former and checking the latter. The value for this purpose is well brought out by the striking local contrast caused by the almost unprecedented warmth of last month, with 50° or above (57°·5 twice) on nineteen days and frost on the ground only on the 24th, 25th and 26th, compared with December, 1917, as exceptionally cold. In that year only three flowers opened first after November 30th, against sixteen in 1918.

Except to note the usefulness of roses, space will not allow further indicating the facts illustrated by the table; but comparison is easier as both years gave nearly the same December total and that differs little from the fourteen years mean.

Flowers in bloom at Purley (330-400 ft.), and Wild Flowers casually noted in District:—

	Wild Flowers.	Roses.	Other Garden Flowers.	Total.	Fresh Season's Flowers.	
					Garden.	Wild.
1917..... *a*	46	32	62	140	20	2
1917/8..... *b*	11	2	30	43	...	...
1918..... *a*	44	25	65	134	17	3
1918/9..... *b*	37	16	56	109	...	...
4 years mean..... *a*	40	30	52	122	17	3½
,, ,, ... *b*	30	14	44	88	...	..

a—During December.
b—From Sunday before Christmas to Sunday of or after New Year's Day.

Asgarth, Purley, January 5th, 1919.

J. EDMUND CLARK.

BAROMETRIC PRESSURE AND THUNDERSTORMS.

In respect to Mr. Weston's letter in the November number I have often pointed out in this Magazine what I think is officially well-known, that in this country the real thunderstorms occur with a complex and irregular pressure distribution, especially in the neck or between anti-cyclones. Thunder showers or storms of a milder kind often occur with a definite cyclonic distribution; but, speaking generally, true cyclonic conditions involving much general wind motion are not favourable in this country to severe electrical development. Personally I never take a summer thunderstorm seriously if there is anything like a conspicuous amount of general surface wind on the day in question, and I find it a golden rule. Mr. Weston might study the condition attending the series of terrific thunderstorms that characterized the two very hot Mays of 1917 and 1918. L. C. W. BONACINA.

Hampstead, December 4th, 1918.

CLOUD BURST NEAR HEMEL HEMPSTEAD.

At 18h. 20m., upon the roof of the small conservatory off my dining-room, there was a sound as of a violent hail-storm. There was, however, no hail, but rain in veritable sheets, so thick that I could hardly see the clouds which were very low and sombrely threatening. The duration of rain was about three minutes. At 21h. the rain was standing on the lawn, and I measured 8·3 mm.

The total duration of rain between 9h. and 21h. was at the outside an hour, from 17½h. to 18½h., and the rain was ordinary rain fairly heavy, nearly the whole of the rain falling in the three minutes of the cloud-burst.

The squall marked the passage of the trough of a depression, the motion of which across the Midlands appears to have been rather irregular. Heavy rain occurred at Amersham (about 18h. 15m.), and at Aylesbury. There was also rain in some parts of London between 18h. and 19h., though none was recorded at Kew Observatory or at the Meteorological Office. The squall occurred at Richmond at 18h. 33m., when the maximum wind speed was 19 miles per second, and the wind direction changed from W.S.W. to W.N.W.; not only was there an absence of rain, but another characteristic feature of the true line squall was lacking in the South Kensington record; there was no sudden drop of temperature, but a slight rise from 18h. to 19h., though this was followed by a steady fall of 2°·5 (centigrade) in the next hour.

Reference must also be made to a remarkable difference in character between the barometric conditions before and after the passage of the squall. During the period when the pressure was falling generally, there were continuous oscillating disturbances

so that the microbarogram for South Kensington is marked by a series of serrations. A rapid rise of pressure took place about 9h. 40m. (?), and from 19h. 50m. onwards there was hardly any variation.

I do not understand the rapid rise at 9h. 40m. as my barograph shows roughly a fall of half an inch between 0 and 6h. on the 18th, was steady from 6h. to 11½h., fell nearly half an inch from 11½h. to 18h., and then exhibited a slight steady rise.

Golden Parsonage, Hemel Hempstead. ELLIOTT KITCHENER.

VOLUNTARY OBSERVERS AND THE NEW STAR.

ANENT your interesting paragraph, "Voluntary Observers and the New Star," in the *Meteorological Magazine* for September, one at any rate of the 5,000 odd Observers connected with the British Rainfall Organization was an independent "discoverer" of the new star in Aquila. That Observer was myself. From my youth up astronomy and astronomical phenomena have had a fascination for me, and on that eventful Saturday night, June 8th, as is almost invariably my nightly custom, I went out of doors about 10.40 o'clock (G.M.T.) to look round the sky and at the weather.

It was a fine starlit night, and on gazing eastward among a number of bright, familiar orbs, I was attracted by a specially bright one I could not name. I knew it was not a planet, and I could think of no such brilliant star (just a trifle fainter than Altair, near by) at that particular spot. I was convinced then and there that I was looking at a *nova* and, on going indoors, settled the matter by reference to books. It was a rather startling discovery, and equally a piece of rare good luck.

The next night the increased brightness was further confirmation of the fact that a brilliant new star had apparently suddenly blazed out. The question was: When had it been first seen? for no outside news of the discovery had so far come. I had to wait for the answer until the Tuesday morning when Monday's English papers came to hand, then I knew that I had been among the earliest to see the intruder.

Miss Grace Cook, of Stowmarket, was credited with being the first to see the stranger light. This she did at 9.30 G.M.T., and rather more than an hour later I was fortunate enough to detect it myself. Had I telegraphed my discovery to Greenwich Observatory on the Sunday morning I should perhaps have figured with other Observers in the Astronomer Royal's letters to *The Times*. But I did not do so, and consequently lost the chance of honourable mention in connection with an astronomical event so exceedingly interesting and so rare. BASIL T. ROWSWELL.

Les Blanches, St. Martin's, Guernsey, October 28th, 1918.

HEAVY RAIN IN CEYLON.

I HAVE an interesting record which has been sent to me by my brother in Ceylon, Mr. T. H. Chapman, Director of Public Works, Columbo. He tells me that on November 17th, at Jaffna, there were 20·63 in. of rain in 16 hours. Previous records at the same gauge are :—1884—9·92 in. in 24 hours ; 1913—9·64 in. in 24 hours.

SAMUEL C. CHAPMAN.

Town Hall, Torquay, January 7th, 1919.

ROYAL METEOROLOGICAL SOCIETY.

A MEETING was held on December 18th, at 70, Victoria Street, S.W., Sir Napier Shaw, F.R.S., President, in the Chair.

A paper was read by Capt. C. J. P. Cave, R.E., entitled, "A Cloud Phenomenon." On April 15th, 1915, a cloud, with an approximately straight front, approached South Farnborough from the north-west, coming overhead at 9.33 a.m., after which the sky was overcast. At all stations in the eastern and south-eastern counties the record was similar, though the times of cessation of sunshine differed considerably. By comparing the records it was possible to draw an isochronous map showing the times when the cloud front was approximately overhead. At 9 a.m. the line ran from the Isle of Wight to Cromer, at 10 a.m. from the east end of the Isle of Wight, through south-east London, to the sea north off Yarmouth, and at 2 p.m. from between Pevensey and Bexhill to Westgate. The map showed the travel of the cloud front from 7 a.m. to 3 p.m. moving at about 12 miles per hour.

Mr. J. E. Clark, Capt. Wilson-Barker, Mr. R. H. Hooker, Mr. Carle Salter and the President, took part in the discussion, in which the analogy with the isochronous lines of the snow-storm of December 25th-26th, 1906, was referred to (*See British Rainfall*, 1906, p. 25).

A paper by Mr. C. E. P. Brooks, on "A Meteorological Journal at Wei Hai Wei, kept by Comm. A. E. House, 1910 to 1916," was also read. Wei Hai Wei, in the north of China, has a cool summer with a moderate rainfall and a dry bracing winter. Meteorological observations were taken by Comm. House four times daily and include pressure, temperature, humidity, rainfall, wind and weather. These have been summarized and discussed, with notes on the relation of the various elements to wind direction, and on the general climatology and possibilities of Wei Hai Wei.

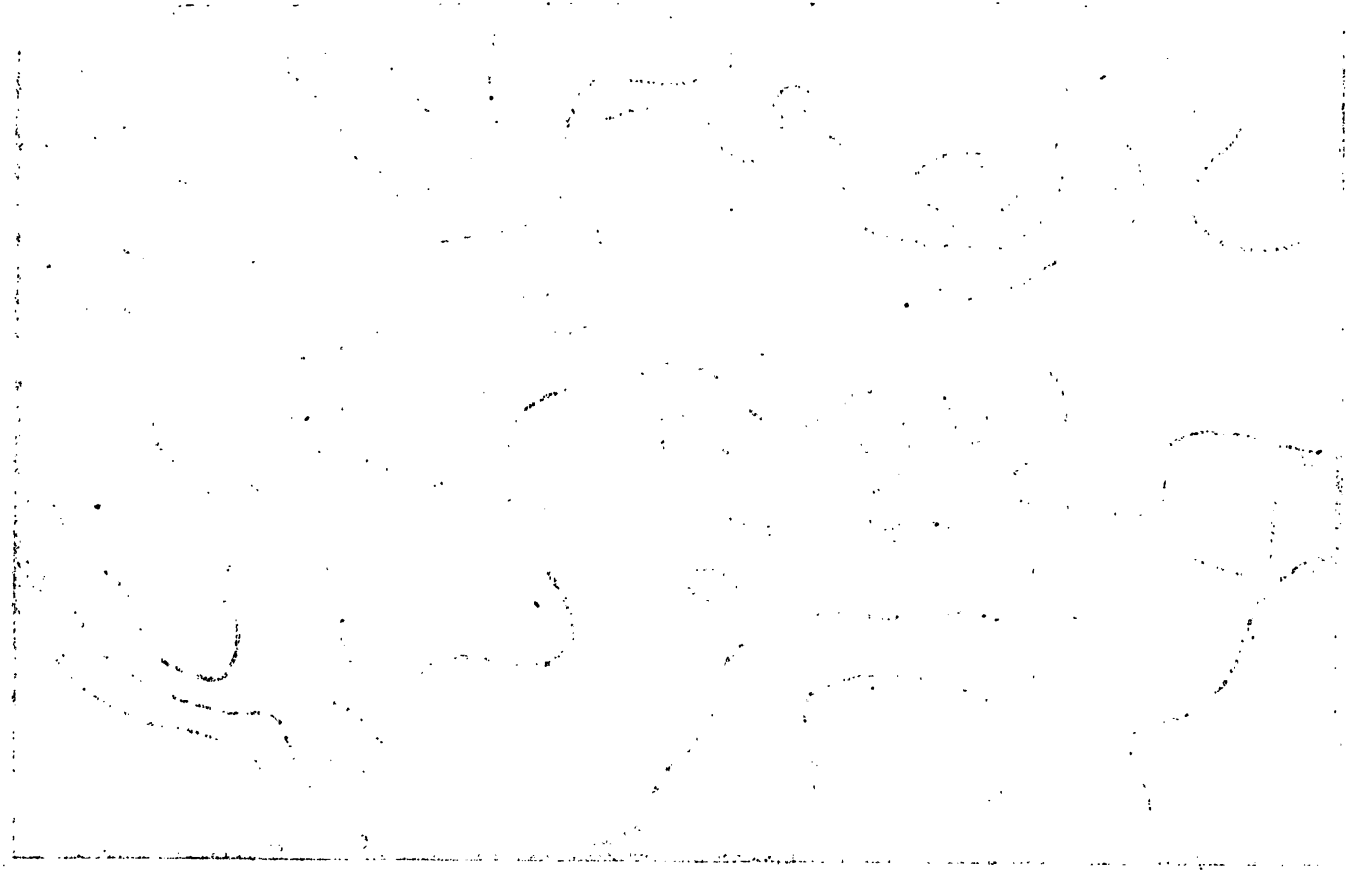
Sir Napier Shaw in expressing the indebtedness of meteorologists to Comm. House, and to Mr. Brooks for enabling these valuable

results to be placed on record, suggested that climatologists were apt to push too far the principle of the monsoon as a factor of climate and as a consequence to neglect other important features.

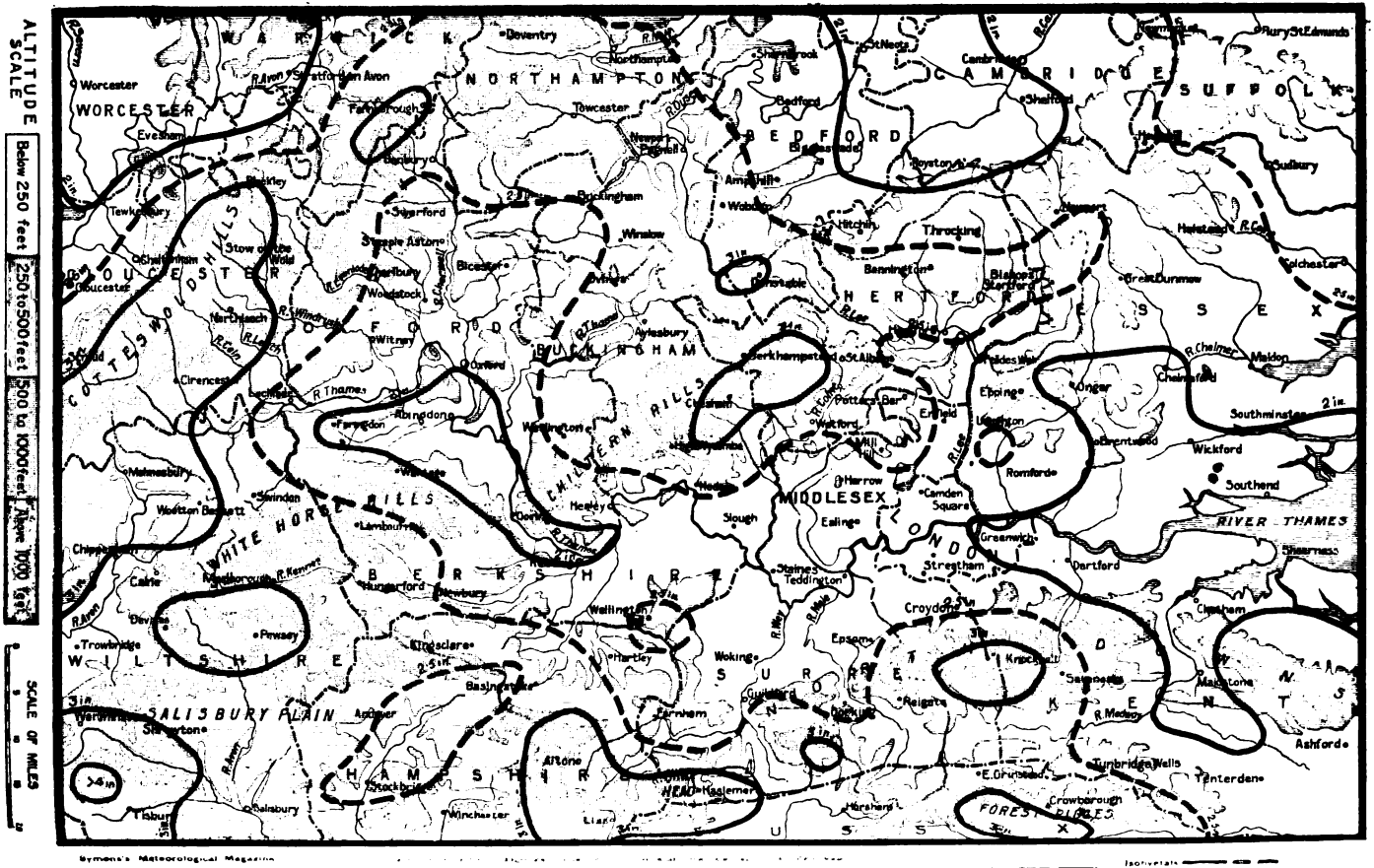
A paper on "Annual Symmetrical Variation and the Choice of Seasons," was read by Capt. E. H. Chapman, R.E. The mean monthly temperatures for the Midland counties are most symmetrical for the year from February to January. The mean monthly values of various meteorological elements are symmetrical for the calendar year January to December. Mean weekly temperatures for the Midland counties are symmetrical for a year commencing with the 5th week of one year and ending with the 4th week of the following year. The method used to show annual symmetry was to draw the first half of the curve forwards and the second half backwards along the ordinates of the first half, the nearness of the two portions of the curve showing the degree of symmetry. Annual symmetrical variation makes the division of the year into seasons a difficult matter. There is evidence in favour of making March a winter month. The usual meteorological three monthly seasons are too early in the year, while the astronomical seasons are too late. An alternative suggestion of three monthly seasons, from the middle of December to the middle of March, etc., was put forward.

An animated discussion took place turning on the choice of seasons for meteorological purposes. Mr. C. Harding strongly advocated calling December a winter month and March a spring month, relying principally upon temperature and sunshine data. Mr. L. C. W. Bonacina spoke of the contrasts between the weather of the solstitial seasons, and Dr. C. Chree of the seasonal magnetic variations suggesting November to January as the true winter period. Major Taylor called attention to the earlier temperature seasons in the atmospheric strata at a level of 14 kilometres above the Earth. Sir Napier Shaw in deprecating any attempt to define too rigidly the seasonal limits mentioned that these varied widely in different parts of the globe, and also that the names of the seasons had a traditional significance in literature which they would probably retain in spite of any attempt to restrict their meaning for particular purposes.

The following candidates were balloted for and elected Fellows of the Society :—Miss M. Proctor, Messrs. G. E. Barton, F. L. Halliwell, J. Morrison, A. Payze, W. H. Rose, W. A. Ru Keyser, G. F. Simpson, W. H. G. Spindler, J. S. Turner, J. F. Woodroffe, J. B. Williamson, L. Whitwam.



THAMES VALLEY RAINFALL DECEMBER, 1918.



THE WEATHER OF DECEMBER.

THE ruling feature, so far, in the weather of the present winter, has been the almost ceaseless arrival on our shores of Atlantic storm systems, bringing with them volumes of air, usually mild and very humid, and, in short, of distinctly oceanic origin.

In the earlier half of December most of the disturbances passed northward or north-eastward, beyond the Irish and Scottish coasts. The prevailing winds were therefore southerly or south-westerly, often strong in force, and reaching a gale in the west between the 10th and 12th, when the gusts at Falmouth (Pendennis Castle), and Quilty (Co. Clare) attained a velocity of seventy miles per hour. The weather was, as a rule, extremely mild, more especially in the opening week, and again on the 12th or 13th. On each occasion the midday temperatures reached 55°, or more, in nearly all parts of the country, a reading as high as 60° being recorded at Dublin on the 4th, at Scarborough on the 5th, and at Birr Castle on the 8th. Scarcely any frost was experienced over England and Ireland, but in Scotland the nights of the 10th and 11th were seasonably cold, the shade temperature at two high level stations, Balmoral and West Linton, falling respectively to 24° and 25°.

In the latter half of the month, when the centres of the Atlantic disturbances advanced more directly over the United Kingdom, the wind occasionally got round to W. or N.W., and although mild weather still predominated, the fluctuations in temperature were rather considerable. The deepest depressions were those of the 19th to 20th, the 23rd and the 30th. In each case the wind rose to a gale on many parts of the coast, and at Aberdeen, on the 23rd, the gusts from the north-westward reached a velocity of 72 miles per hour. Sharp frost occurred in Scotland on the nights of the 19th and 20th, when the sheltered thermometer fell slightly below 20° in several places. On the grass a reading as low as 15° was recorded at Balmoral, and a reading of 14° at Eskdalemuir and West Linton. During a short spell of clear brisk weather which occurred over England, most opportunely, just at Christmas, frost was experienced further south, shade temperatures slightly below 25° being recorded at several English stations. Over North Britain the minimum readings were in many cases below 20°, and in a few places very little above 15°. Towards the end of the month mild southerly and south-westerly winds again became general, and on the 28th the midday temperature was in many districts as high as 55°.

The mean temperature of December was well above the average, the excess being greatest over eastern, central and southern England. Owing to an occasional brilliantly fine day the total duration of recorded sunshine differed but little from the normal.

Aurora was seen rather frequently in Scotland, and a brilliant display occurred on the 25th, not only over northern districts generally, but as far south as Norfolk and Worcestershire.

The total rainfall was, on the whole, excessive, falling below the average only in the east and centre of Scotland and in a small part of the south of England. More than 50 per cent. above the average fell in the north-west of England, in South Wales and part of the south of Ireland, and the total reached double the average at one or two stations in the north-west of England. Less than 3 inches fell over most of the south-east of England, and almost the whole of the east of Scotland, but hardly anywhere in Ireland. More than 6 inches was general over western districts, and the fall rose to more than 10 inches widely in Wales and other mountainous areas.

The general rainfall, expressed as a percentage of the average, was :—England and Wales, 153; Scotland, 98; Ireland, 139; British Isles, 132.

In London (Camden Square), the mean temperature was 45°·6, or 5°·9 above the average, and the highest value with two exceptions recorded in December in 61 years. The duration of sunshine was 12·1 hours, and of rainfall 60·1 hours. Evaporation, ·24 inches.

RAINFALL TABLE FOR DECEMBER, 1918.

STATION.	COUNTY.	RAINFALL. Aver. 1875—1909. in.	1918. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Date.	Nos. of Day
Camden Square	*London*	2·13	2·34	+ ·21	110	·41	10	25
Tenterden	*Kent*	2·77	2·08	— ·69	75	·32	17	27
Arundel (Patching)	*Sussex*	2·91	2·50	— ·41	86	·44	9	23
Fordingbridge (Oaklands)	*Hampshire*	3·35	3·10	— ·25	93	·48	10	26
Oxford (Magdalen College)	*Oxfordshire*	2·06	1·99	— ·07	97	·29	22	24
Wellingborough (Swanspool)	*Northampn*	2·13	2·24	+ ·11	105	·42	18	25
Bury St. Edmunds (Westley)	*Suffolk*	2·14	3·01	+ ·87	141	·54	18	25
Geldeston [Beccles]	*Norfolk*	2·07	3·08	+1·01	149	·43	28	27
Polapit Tamar [Launceston]	*Devon*	4·46	6·54	+2·08	147	·55	4	30
Rousdon [Lyme Regis]	,,	3·68	3·19	— ·49	87	·47	21	27
Stroud (Field Place)	*Gloucester*	2·71	2·94	+ ·23	109	·78	20	15
Church Stretton (Wolstaston)	*Shropshire*	2·99	4·67	+1·68	156	·48	2	19
Boston	*Lincoln*	1·88	2·62	+ ·74	139	·41	28	27
Worksop (Hodsock Priory)	*Nottingham*	2·17	2·65	+ ·48	122	·45	19	20
Mickleover Manor	*Derbyshire*	2·38	3·87	+1·49	162	·54	22	23
Congleton (Buglawton Vic.)	*Cheshire*	2·89	5·09	+2·20	176	·60	28	28
Southport (Hesketh Park)	*Lancashire*	3·10	6·68	+3·58	215	·88	15	27
Wetherby (Ribston Hall)	*York, W.R.*	2·27	5·08	+2·81	224	1·08	22	16
Hull (Pearson Park)	,, *E.R.*	2·32	3·10	+ ·78	134	·43	15	23
Newcastle (Town Moor)	*North'land*	2·46	3·60	+1·14	146	·77	30	18
Borrowdale (Seathwaite)	*Cumberland*	15·14	33·83	+18·69	223	...	...	...
Cardiff (Ely)	*Glamorgan*	4·70	7·03	+2·33	150	·85	26	30
Haverfordwest	*Pembroke*	5·18	8·06	+2·88	156	·93	2	27
Aberystwyth (Gogerddan)	*Cardigan*	4·66	8·09	+3·43	174	·87	2	26
Llandudno	*Carnarvon*	2·84	3·50	+ ·66	123	·54	15	25
Cargen [Dumfries]	*Kirkcudbrt.*	4·84	5·41	+ ·57	112	·85	30	24
Marchmont House	*Berwick*	2·83	2·26	— ·57	80	·56	22	16
Girvan (Pinmore)	*Ayr*	5·48	6·82	+1·34	124	·65	23	28
Glasgow (Queen's Park)	*Renfrew*	3·95	3·98	+ ·03	101	·83	23	23
Islay (Eallabus)	*Argyll*	5·73	7·79	+2·06	136	·73	22	31
Mull (Quinish)	,,	6·59	8·40	+1·81	127	·89	19	29
Balquhidder (Stronvar)	*Perth*	8·83	...	...	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	2·67	1·65	—1·02	62	·28	22	19
Braemar	*Aberdeen*	3·13	2·10	—1·03	67	·70	24	19
Aberdeen (Cranford)	,,	3·43	2·36	—1·07	69	·49	22	23
Gordon Castle	*Moray*	2·72	2·50	— ·22	92	·32	30	21
Drumnadrochit	*Inverness*	3·76	2·95	— ·81	78	·44	11	23
Fort William	,,	9·41	7·72	—1·69	82	·65	11	26
Loch Torridon (Bendamph)	*Ross*	9·86	9·07	— ·79	92	·73	26	27
Dunrobin Castle	*Sutherland*	3·09	4·13	+1·04	130	·55	22	17
Glanmire (Lota Lodge)	*Cork*	5·29	6·84	+1·55	129	1·02	7	27
Killarney (District Asylum)	*Kerry*	6·92	9·56	+2·64	138	·95	7	30
Waterford (Brook Lodge)	*Waterford*	4·32	5·50	+1 18	127	·65	14	22
Nenagh (Castle Lough)	*Tipperary*	4·34	7·18	+2·84	165	·80	18	25
Ennistymon House	*Clare*	5·03	8·21	+3·18	164	1·28	21	30
Gorey (Courtown House)	*Wexford*	3·42	6·20	+2·78	181	1·35	15	22
Abbey Leix (Blandsfort)	*Queen's Co.*	3·41	4·89	+1·48	143	·68	18	24
Dublin (Fitz William Square)	*Dublin*	2·27	2·53	+ ·26	111	·58	15	23
Mullingar (Belvedere)	*Westmeath*	3·39	4·16	+ ·77	123	·60	2	22
Crossmolina (Enniscoe)	*Mayo*	6·11	7·67	+1·56	125	·95	17	30
Cong (The Glebe)	,,	5·42	7·01	+1·59	129	·68	17	29
Collooney (Markree Obsy.)	*Sligo*	4·34	6·45	+2·11	148	·64	28	29
Seaforde	*Down*	3·77	4·89	+1·12	130	1·06	28	25
Ballymena (Harryville)	*Antrim*	3·97	5·10	+1·13	128	·71	28	29
Omagh (Edenfel)	*Tyrone*	3·91	5·06	+1·15	129	1·00	28	25

SUPPLEMENTARY RAINFALL, DECEMBER, 1918.

Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	3·15
,,	Ramsgate	1·75
,,	Hailsham	2·65
,,	Totland Bay, Aston House...	2·68
,,	Stockbridge, Ashley..	2·82
,,	Grayshott	3·30
III.	Harrow Weald, Hill House...	2·15
,,	Pitsford, Sedgebrook..	2·41
,,	Woburn, Milton Bryant	2·62
,,	Chatteris, The Priory	1·68
IV.	Elsenham, Gaunts End	2·69
,,	Shoeburyness	...
,,	Colchester, Hill Ho., Lexden	2·65
,,	Ipswich, Rookwood, Copdock	2·88
,,	Aylsham, Rippon Hall	3·75
,,	Swaffham	3·79
V.	Bishops Cannings	3·52
,,	Weymouth	2·59
,,	Ashburton, Druid House	8·34
,,	Cullompton	4·83
,,	Lynmouth, Rock House	7·19
,,	Okehampton, Oaklands	7·65
,,	Hartland Abbey	5·66
,,	St. Austell, Trevarna	7·59
,,	North Cadbury Rectory	3·15
VI.	Clifton, Stoke Bishop	4·39
,,	Ledbury, Underdown	2·30
,,	Shifnal, Hatton Grange	3·59
,,	Droitwich	1·97
,,	Blockley, Upton Wold	3·26
VII.	Grantham, Saltersford	2·50
,,	Louth Westgate	3·46
,,	Bawtry, Hesley Hall	2·74
,,	Whaley Bridge, Mosley Hall	8·37
,,	Derby, Midland Railway	3·78
VIII.	Nantwich, Dorfold Hall	4·96
,,	Bolton, Queen's Park	9·76
,,	Lancaster, Strathspey	7·51
IX.	Langsett Moor, Up. Midhope	5·48
,,	Scarborough, Scalby	5·25
,,	Ingleby Greenhow	3·59
,,	Mickleton	3·90
X.	Bellingham, High Green Manor	2·91
,,	Ilderton, Lilburn Cottage	2·15
,,	Keswick, The Bank	6·97
XI.	Llanfrechfa Grange	5·45
,,	Treherbert, Tyn-y-waun	...
,,	Carmarthen, The Friary	8·73
,,	Fishguard, Goodwick Station.	6·47
,,	Crickhowell, Tal-y-maes	7·50
,,	Gwern-y-argllwydd	3·80
,,	Birmingham WW., Tyrmynydd	10·91
,,	Lake Vyrnwy	11·05
,,	Llangynhafal, Plas Drâw	3 91
,,	Rhiwbryfdir	16·97
,,	Dolgelly, Bryntirion	9·23
XI.	Lligwy	6·56
,,	Douglas, Isle of Man	...
XII.	Stoneykirk, Ardwell House	7·50
,,	Carsphairn, Shiel	9·57
,,	Langholm, Drove Road	5·32
XIII.	Selkirk, The Hangingshaw	2·06
,,	North Berwick Reservoir	1·38
,,	Edinburgh, Royal Observaty.	1·50
XIV.	Biggar	2·63
,,	Maybole, Knockdon Farm	4·69
XV.	Buchlyvie, The Manse	...
,,	Ardgour House	12·10
,,	Oban	8·11
,,	Campbeltown, Witchburn	...
,,	Holy Loch, Ardnadam	9·39
,,	Tiree, Cornaigmore	...
XVI.	Glenquey	5·20
,,	Loch Rannoch, Dall	4·94
,,	Blair Atholl	2·76
,,	Coupar Angus	1·36
,,	Montrose, Sunnyside Asylum.	1·70
XVII.	Balmoral	2·34
,,	Fyvie Castle	2·72
,,	Keith Station	3·28
XVIII.	Rothiemurchus	2·13
,,	Loch Quoich, Loan	18·50
,,	Skye, Dunvegan	9·69
,,	Fortrose	2·34
,,	Glencarron Lodge	7·84
XIX.	Tongue Manse	4·64
,,	Melvich	4·70
,,	Loch More, Achfary	8·18
XX.	Dunmanway, The Rectory	12·41
,,	Mitchelstown Castle	5·77
,,	Gearahameen	18·00
,,	Darrynane Abbey	5·92
,,	Clonmel, Bruce Villa	4·81
,,	Broadford, Hurdlestown	7·35
XXI.	Enniscorthy, Ballyhyland	6·02
,,	Rathnew, Clonmannon	4·04
,,	Ballycumber, Moorock Lodge	4·49
,,	Balbriggan, Ardgillan	3·30
,,	Castle Forbes Gardens	4·53
XXII.	Ballynahinch Castle	7·70
,,	Woodlawn	4·64
,,	Westport House	2·44
,,	Dugort, Slievemore Hotel	7·21
XXIII.	Enniskillen, Portora	4·76
,,	Dartrey [Cootehill]	4·40
,,	Warrenpoint, Manor House	4·24
,,	Belfast, Cave Hill Road	4·86
,,	Glenarm Castle	4·69
,,	Londonderry, Creggan Res.	5·43
,,	Milford, The Manse	5·42
,,	Killybegs	8·78

Climatological Table for the British Empire, July, 1918.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, CamdenSquare	83·5	1	46·1	4	73·3	54·1	53·8	73	92·3	42·9	4·74	18	6·2
Malta	93·6	23	67·5	8	79·6	72·6	...	77	144·0	...	·00	0	1·4
Lagos	87·5	25	72·0	3	82·4	73·8	71·7	81	148·2	70·0	1·03	11	8·0
Cape Town	77·0	14	38·6	25	61·4	48·9	48·0	79	...	...	3·66	12	5·1
Johannesburg	68·2	18	25·1	28	59·6	41·1	34·0	64	...	24·1	·30	3	3·6
Mauritius	75·9	3	53·8	31	73·2	60·3	59·2	78	...	46·1	3·88	26	5·8
Bloemfontein	71·3	20	19·4	25*c*	60·5	33·8	33·6	68	..	...	1·74	5	3·3
Calcutta...	97·0	17	75·2	14	91·4	80·1	78·7	83	...	74·5	7·64	13	8·3
Madras	103·2	12	75·9	2	99·0	80·2	70·2	61	162·4	74·3	·65	5	4·8
Colombo, Ceylon ...	87·7	11	75·2	15*d*	86·4	78·1	73·2	77	153·6	72·5	3·11	13	7·6
Hongkong	91·2	14	74·2	1	86·5	78·4	76·5	84	...	...	11·64	19	7·9
Sydney	70·6	5	37·4	11	61·6	44·5	41·7	72	113·9	28·0	3·26	11	3·6
Melbourne	61·8	5	31·0	21	54·7	42·3	40·7	73	115·1	21·4	1·74	13	7·0
Adelaide	62·5	3	36·3	21	58·4	42·7	44·0	78	122·5	25·1	2·62	15	5·9
Perth	69·6	7	40·1	15	63·7	46·6	45·9	73	126·2	30·9	3·37	6	3·3
Coolgardie	76·8	7	35·5	16	61·0	41·6	39·9	62	131·0	29·2	·62	4	5·5
Brisbane	...	...	...	...	...	...	...	...	...	...	...	...	...
Hobart, Tasmania ..	58·9	6	31·9	22	52·5	39·7	37·3	68	107·0	26·9	3·20	27	6·3
Wellington ...	59·0	8	30·1	27	51·6	39·4	38·6	77	115·0	17·7	4·99	20	5·4
Jamaica, Kingston ..	92·7	11	70·6	9	90·0	73·5	70·6	74	...	...	·24	4	3·4
Grenada	87·0	17*a*	70·0	7	83·0	74·0	...	77	137·0	...	10·57	18	4·0
Toronto	92·4	21	48·0	2	80·5	58·8	58·8	73	144·8	45·0	2·32	7	4·8
Fredericton	91·5	27	48·0	25	74·7	56·8	60·1	82	...	...	7·35	21	6·8
St. John, N.B. ...	78·0	17*b*	39·0	30	61·2	45·4	45·0	83	133·3	31·3	2·25	13	7·0
Victoria, B.C.	78·5	17	46·0	2	66·6	51·2	51·0	77	136·0	39·0	·48	4	5·1

a—26, 29. *b*—12, 31. *c*—26. *d*—27.

Johannesburg.—Bright sunshine 260·7 hours.

COLOMBO, CEYLON.—Mean temp. 82°·2, or 1°·1 above, dew point 0°·8 below, and R 3·17 in. below, averages. Mean hourly velocity of wind 5·7 miles.

HONGKONG.—Mean temp. 81°·8. Bright sunshine 174·8 hours. Mean hourly velocity of wind 9·9 miles.

Sydney.—The lowest July temperature since 1890.

Adelaide.—Mean temp. 1°·0 below, and R ·30 in. below, averages.

Perth.—Rainfall 3·21 in. below average, lowest for July since 1889.

Coolgardie.—Temp. 0°·3 above, and R about ·25 in. below, averages.

Hobart.—Rainfall 1·21 in above average.

Wellington.—Mean temp. 1°·3 below, and R ·97 in. below, averages. Bright sunshine, 127·4 hours.

THIS NUMBER IS THE FIRST OF A NEW VOLUME.

EXCHANGE
MAR 1 1919

NO. 637 SYMONS'S VOL. 54

METEOROLOGICAL MAGAZINE

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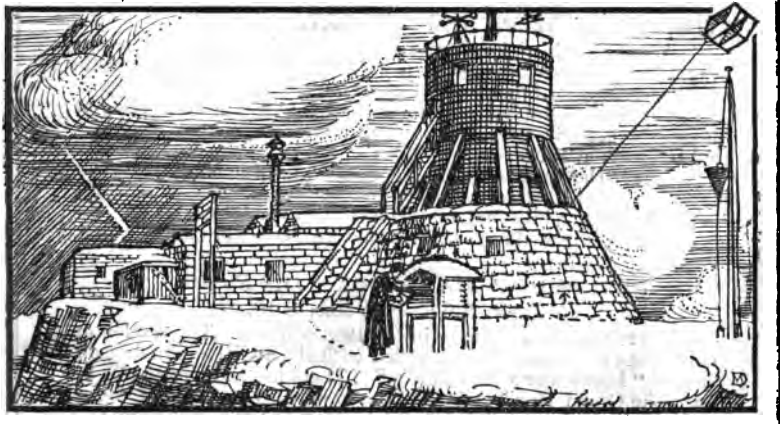

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Symons's
Meteorological Magazine.

No. 637. FEBRUARY, 1919. Vol. LIV.

WEATHER MAPS IN NEWSPAPERS.

On January 1st the *Morning Post* commenced the publication of the daily weather chart prepared by the Meteorological Office from the 6 p.m. observations. The area included extends from Iceland in the north-west to Corsica in the south-east, the British Isles having a central position and the west of continental Europe, from Scandinavia to the Pyrenees being shown. Isobars are given for intervals of 5 millibars, and the lines are numbered at one end with the pressure in millibars, at the other with the height of the mercurial barometer in inches and hundredths. As the map extends across two columns it is very clear and legible, a great advance on any previous presentation of a weather chart in a British newspaper.

In introducing the new feature the *Morning Post*, under the heading of "A fascinating daily study," started a series of meteorological articles with the happy quotation from Ruskin :—

> "While the geologist yearns for the mountain, the botanist for the field, and the mathematician for the study, the meteorologist like a spirit of a higher order than any, rejoices in the kingdom of the air."

The writer understands that a new era in public appreciation of meteorology began with the armistice, and he says : "In all educational establishments, from the Universities, through the Training Colleges, down to the elementary schools, familiarity with the daily Weather Map, and its indications, has now become an imperative necessity. Lectures based upon the many erroneous theories of pre-Weather Map days which are found in most text books, and illustrated by diagrams of a generation or half a century ago, are out of date—they are the dried-up, lifeless bones out of which there comes no sustenance. What is now required is the living thing, something that appeals to and interests the scholar because he feels that he is being taught to appreciate what he is experiencing at the moment. This living thing is the Weather Map which a very large proportion of the readers of the *Morning Post* will have served up with breakfast every morning, and in more distant regions by mid-day."

The spirit of this paragraph is that spirit of triumphant hope that "springs eternal" from the ashes of the past. It has now a better opportunity than ever before to be justified by the spread of knowledge. We welcome the enthusiasm with which the *Morning Post* has inaugurated the teaching of weather-lore to its readers. Our readers, of course, know that the value of the weather map was known and appreciated even a generation ago and this fact makes them the happier for every fresh recognition.

We were alarmed, fortunately without reason, when *The Times* failed to resume its familiar discussion of the weather; but in due course the new large-scale weather map began to appear in its columns also, though the absence of shading to distinguish land from water makes it at first sight less effective than that in the *Morning Post*. We cannot forget that it is due to the enterprise of *The Times* that weather maps first appeared in a daily paper; nay more, that it is to that journal we owe the first construction of a 6 p.m. map by the Meteorological Office. This is now an old story, but it is worth while to remember that for a time more than forty years ago, the cost of the 6 p.m. weather report was borne by a newspaper. *The Times* report before the war made a feature of a natural-scale diagram showing the hourly readings of the great glycerine barometer which was one of the peculiar glories of Printing House Square. When a rapid rise or fall of pressure occurred half a column or more was filled with this diagram and we can hardly wonder that it has been suppressed. The space is more usefully occupied by a special report on Aviation Weather.

The superior clearness and larger scale of the new weather maps respond worthily to the impulse which the war has given to Meteorology in all its aspects; but a tribute of affectionate memory is due all the same to the rough and ugly little maps that headed *The Times* weather column until 1914. When the isobaric map first appeared it was a small journalistic triumph, for in those days there were no cheap and easy photographic processes for reproducing drawings to print with type, and students of forty years ago remember how this map of the weather appealed to them when they saw it for the first time. Out of fashion and grotesque as the little map would now appear it possessed one advantage which its up-to-date successor lacks: it was just the right size to trace off as a lantern slide, and many University Extension and Gilchrist Trust lecture audiences have seen the weather map published that morning filling a 20-foot screen. Old lecturers on the weather must regret the old map for this reason alone, for they have often traced the isobars by scraping out the lines on a blue waxed plate a few minutes before the lecture began in some remote village where the London newspapers are not delivered until the evening, and made a slide of it by binding the tracing to a cover-glass prepared in advance with the outline of the British Isles in black. The *Morning Post* articles to which we

have referred show that the appeal of "Earth's young significance" still rouses the same enthusiasm which fired those whose efforts to popularize meteorology in the later decades of last century were helped by the old *Times* map. Though we do not wish it back, we retain some gratitude for the enterprise which started it and kept it going during the period of popular indifference, which we trust, has now passed away for ever.

Correspondence.

To the Editor of Symons's Meteorological Magazine

THE SNOWSTORM OF JANUARY 4th AND 5th.

In this country a very low barometer in a winter month, especially, perhaps, in January, when the general level of temperature is at a minimum generally means cold and snow, except when and where a long-distance north-west current from the Atlantic may be transporting warmth. In the little cyclonic depression which moved north-eastward across England from France on the evening of January 3rd, becoming deeper, larger and more intense as it progressed there was no warm current in the circulation at all; but the temperature on the night of the track where the wind was from southerly points, was just high enough to permit of a heavy fall of rain in Northern France and the south-east of England, in place of a very severe snowstorm which visited the north, midlands and west of England, where the winds were from northerly points on the left of the track. The meteorological circumstances of this storm are most interesting, and it is to be hoped that it may be found possible to show on a map the distribution of snow and rain. It is probable that in Kent, Surrey and Sussex, where the temperature was only just high enough for rain, the elevated tracts of country approaching 1,000 feet above the sea, would stand out as altitudinal outlines of the snowfall which in the parts of England lying further west and north was very deep in the lowlands. The experiences of travellers on the Great Western Railway would be interesting if known. Assuming that the transition zone between rain and snow was somewhere in the neighbourhood of Reading, where the fields would be looking grey, a little further west the White Horse Hills would appear as altitudinal outlines of the deep snow which farther west, still in Wilts and Somerset, was lying in the lowlands. Apparently Cornwall in the extreme west lay for the most part outside the area of the storm. There is no doubt that the altitudinal outlines of this heavy lowland snowstorm would be highly instructive could they be depicted on a map. L. C. W. BONACINA.

January, 11th 1919.

A WINTER THUNDERSTORM.

A THUNDERSTORM started on January 10th, at 7 p.m., with a very vivid flash, followed by others at 7.5 and 7.8 p.m.; the first thunder being at 7.8 p.m. Intermittent flashes, with and without thunder, were continued at intervals till 9.45 p.m. Hail fell in large quantities and heavy rain. The wind, which was very light, was from the south-west, and rain continued the whole night.

HAROLD R. PINK.

The Mount, Fareham, January 11th, 1919.

REMARKABLE UNIFORMITY OF TEMPERATURE.

FOR the last ten days, January 28th to February 6th inclusive, the range of temperature here has amounted to only 9°·3. During this period the ground has been snow-covered to the depth of about 3 inches, the sky densely overcast, with frequent falls of snow, the wind light from north to east. The following are the maximum and minimum temperatures in the screen :—

		Max.	Min.			Max.	Min.
January	28th	35°·5	30°·5	February	2nd	32°·5	29°·2
,,	29th	36°·0	28°·7	,,	3rd	33°·2	30°·0
,,	30th	32°·0	31°·0	,,	4th	35°·5	30°·0
,,	31st	30°·5	26°·7	,,	5th	35°·0	30°·0
February	1st	32°·2	27°·0	,,	6th	35°·5	30°·7

H. K. G. ROGERS.

Glenart, Weybridge, February 6th, 1919.

Mr. William Allingham.

WE have to record, with regret, the sudden death, on January 24th, of Mr. William Allingham, for many years Principal Assistant in the Marine Branch of the Meteorological Office. Mr. Allingham's early life was spent at sea, but, owing to a disabling accident, he obtained, in the early seventies, a post in the Admiralty, while in 1875 he was transferred, at the age of twenty-five, to the Staff of the Meteorological Office. In addition to a practical knowledge of Navigation and Meteorology Mr. Allingham was gifted with considerable literary ability. His chief works were the compilation of a *Manual of Marine Meteorology*, and, in conjunction with Captain Wilson-Barker, Commander of H.M.S. *Worcester*, a valuable treatise on *Navigation, Practical and Theoretical*. He edited the later editions of Lecky's *Wrinkles in Practical Navigation*, and was an active contributor to various magazines and journals, among which may be mentioned *The Nautical Magazine, The Syren*, and the *Liverpool Journal of Commerce*. F.J.B.

ROYAL METEOROLOGICAL SOCIETY.

THE Annual General Meeting of this Society was held on January 15th, at Burlington House, Sir Napier Shaw, F.R.S., President, in the Chair. The report of the Council for 1918 was read and adopted, and the Council for 1919 was duly elected, as follows :—

President : Sir Napier Shaw, D.Sc., LL.D., F.R.S.; *Vice-Presidents :* T. W. Backhouse, Francis Druce, Capt. A. J. Walker, F. J. W. Whipple; *Treasurer :* W. Vaux Graham, C.E.; *Secretaries:* W. W. Bryant, J. S. Dines; *Foreign Secretary:* R. G. K. Lempfert; *Councillors:* C. E. P. Brooks, Capt. C. J. P. Cave, R.E.; J. E. Clark, Capt. G. M. B. Dobson, Lieut.-Col. E. Gold, D.S.O., R.E., Lieut. H. D. Grant, R.N.V.R., R. H. Hooker, Lieut.-Col. H. Mellish, C.B., Carle Salter, W. Sedgwick, Maj. G. I. Taylor, R.F.C., Prof. H. H. Turner, D.Sc., D.C.L., F.R.S.

Sir Napier Shaw, in an address on "Meteorology : the Society and its Fellows," referred to the change in the position of meteorological work during the war from that of a subject of curiosity which might safely be left to take its chance with such facilities as were left to the ordinary public inexperienced censors and controllers, to that of a matter of such importance in gunnery and navigation of the sea and air that all reference to it was rigorously excluded from the newspapers and a number of special services were improvised to meet the need of meteorological information for our own forces acting in co-operation with corresponding organisations for the French, American and Italian forces. To meet the demand for information about the fundamental principles and practice of the modern science, necessary for those who were called upon to take up technical duties with very limited training, the Meteorological Office had issued a number of books specially written for the purpose. Looking forward, he said that the immediate necessity was the organization of the meteorological services to satisfy the demands of the home countries and meet possible requirements of the dominions beyond the seas. The essential conditions of the organisation were first that there should be a career for men of ability, and secondly that there should be opportunity for suitable preparation by preliminary training in scientific studies, including meteorology, at the universities. At the same time, efficient organization of the public service required that the regular collection of information about the weather should be placed on a proper footing, by arrangement between the central authority and local authorities. The duty which the Society should discharge in the changed conditions was to foster or create an atmosphere which would make a satisfactory national organization on those lines possible by the interchange of ideas and the discussion of meteorological subjects. The steps towards this object would be the continued improvement of the Quarterly Journal of the Society, as a

medium of communication between the fellows, and the development of the use of the library as a reservoir of information. The position of the fellows in relation to the subject would be somewhat changed when the maintenance of the public memory of the weather came to be undertaken as a national duty. But the number of opportunities open to them for active personal co-operation in the development of meteorology, which had not hitherto been fully utilised, was very large. It included observations of special character such as those with self-recording instruments, including the photographic camera, co-operation in making known the progress of the science in other countries, the study of weather in ancient and modern literature and the presentation of a series of episodes in the long history of meteorology and, principally, the setting out of the experience of past and present study in such a way as to create and stimulate the desire for new knowledge upon which the progress of the science must rest.

The following gentlemen were balloted for and elected fellows of the Society :—Capt. J. W. Farnell, Sec.-Lieut. G. F. Henderson, Sec.-Lieut. R. S. Read, Mr. R. Stanley-Davies, Capt. N. B. Weekes, Lieut. F. C. Wood.

METEOROLOGICAL NEWS AND NOTES

Dew Pond Construction was described in some detail in a lecture before the Royal Institute of British Architects on February 3rd by Mr. G. Hubbard, F.S.A., who maintained that it was possible to obtain a water-supply in the absence of springs, rivers and rain, and described an extremely interesting and successful experiment carried out by himself in this connection.

The Norfolk Rainfall Organization's complete monthly rainfall tables, publication of which had been interrupted for some time owing to war conditions, are being resumed in the *Eastern Daily Press* from the beginning of the current year.

Prizes for Weather Essays offered to Enfield school boys and girls are announced by the *Enfield Gazette* of January 10th, 1919. The annual prize for 1918 had unfortunately to be withdrawn owing to the Censor's restrictions.

Errata.—In this Magazine for January, 1919, page 138, last two lines of table :—*for* 4 years *read* 14 years. Page 139, first line of Mr. Kitchener's letter :—after 18h. 20m. *insert* on December 18th.

METEOROLOGY DURING AND AFTER THE WAR.

A LECTURE on this subject was delivered at the Royal Society of Arts on January 22nd, by Colonel H. G. Lyons, R.E., D.Sc., F.R.S., Acting-Director of the Meteorological Office. The chair was taken by Sir Napier Shaw, D.Sc., F.R.S., Meteorological Adviser to the Government.

Colonel Lyons said that the conditions prevailing at the commencement of hostilities were favourable for the advancement of meteorology. At that time, however, there was hardly a career open as a professional meteorologist, and most men working on meteorology were doing so as a hobby. Much valuable research had been carried out, and many difficulties of forecasting were being swept away. The investigation of the upper atmosphere by kites and pilot balloons had made considerable strides. As a result of the war some of this work had to be abandoned, some new work taken up, and the difficulties of carrying on the vastly increased routine of the Meteorological Office with a depleted staff became a serious problem. The cessation of wireless reports, the absence of meteorological information from Central Europe, and the censorship of letters and telegrams added to the difficulties. The need for information from wider areas was soon appreciated and telegraphic reports are now received from Spitzbergen, the north coast of Africa, the Azores and Central Russia. It was thus possible to form a very fair idea of the weather prevailing over the Central Empires. Increased demands for forecasts from the Admiralty and the Royal Air Force led to the institution of a continuous 24-hour forecast service based on reports at 1 a.m., 7 a.m., 1 p.m. and 6 p.m. Telegraphic reports were transmitted to General Headquarters in France for the use of the Allied Armies. A freely expressed wish of aviators and others for reports devoid of all technical terms resulted in the issue of an early morning report based on observations at 1 a.m. and containing a simple description of the prevailing conditions with a forecast. A fuller report was issued on the 7 a.m. observations, and another on the 1 p.m. observations. This was supplemented, for purposes of the General Staff, by a summary of the conditions prevailing on the various fronts and of the anticipated conditions. The present and probable conditions over the Central Empires were also deduced. The highly confidential nature of the work necessitated the use of cypher codes. The loss of Zeppelins in February, 1915, and October, 1917, as well as numerous occasions when they ran into bad conditions and had to return, lend support to the belief that the enemy was kept ignorant as to weather conditions over Western Europe.

The demands of the Special Brigade for trained meteorologists led to the formation of the Meteorological Section of the Royal Engineers in 1915. The Section began with four officers and twenty

other ranks, and at the close of hostilities had increased to five times that number with units at all Army Headquarters, and a force in Salonika. The Section advised aviators as to upper air conditions and the Artillery as to gun-ranging corrections. In addition to the Military Service, the Meteorological Section of the Royal Air Force and the Admiralty Meteorological Service had achieved fine results.

Colonel Lyons maintained that co-operation in the future would be essential to obtain the best results. The most rapid means of transmission of reports are necessary for the forecaster, and the greater use of wireless telegraphy might be confidently looked for. Strict uniformity in regard to instruments, practice and method were needful. There were about 1,000 well-equipped meteorological stations throughout the Empire and free access to the accumulated data should be possible. H.E.C.

SCOTTISH METEOROLOGICAL SOCIETY.

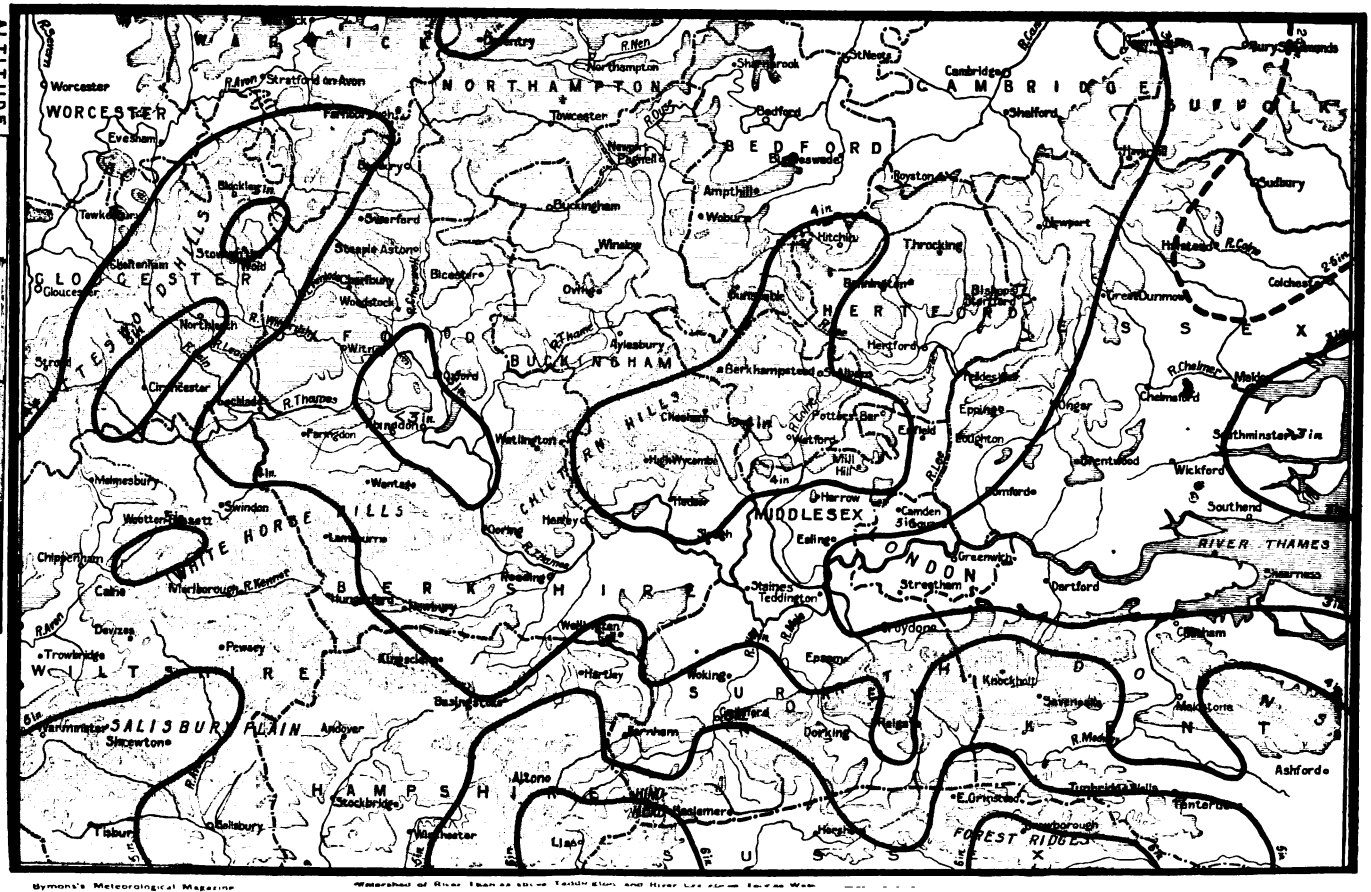
THE Annual Business and General Meeting of the Society was held on December 19th, 1918, in the lecture hall of the Royal Society of Edinburgh, Professor R. A. Sampson, F.R.S., and, afterwards, Dr. C. G. Knott, in the Chair.

The report from the Council referred to the great strain imposed by war conditions on the voluntary system of climatological observations, and to the importance of rainfall work. There had been a slight shrinkage in the membership list, but, during the past four very trying years, the loyalty of the members had been conspicuous.

The following Council and Office-bearers were elected for the ensuing twelve months :—*President :* Dr. C. G. Knott ; *Vice-Presidents :* Prof. T. Hudson Beare, and Mr. J. Mackay Bernard ; *Council :* Mr. D. A. Stevenson, Mr. R. Cross, Mr. S. B. Hog, Mr. G. Thomson, Dr. A. Crichton Mitchell, Mr. G. A. Mitchell, Mr. M. M'Callum Fairgrieve, Prof. R. A. Sampson, F. R. S., Capt. T. Bedford Franklin ; *Honorary Secretary :* Capt. E. M. Wedderburn, R.E. ; *Honorary Treasurer :* Mr. W. B. Wilson, W.S.

Prof. R. A. Sampson, F.R.S., in a paper on "Microbarometers," communicated some critical and historical notes, discussing early microbarometers, the Royal Society of London's water barometer, Hooke's Wheel barometer, Dines's and Casella's barographs and the Shaw-Dines leak barograph. The paper pointed out the importance of studying simultaneous traces upon a sufficiently large scale, of the different meteorological elements. An instrument with an extremely small leak and of remarkable sensitiveness was in use at the Royal Observatory, Edinburgh, and an exhibit was made of some of its records and the simultaneous pressure-tube anemograms.

THAMES VALLEY RAINFALL. JANUARY, 1919.


ALTITUDE SCALE
Below 250 feet
250 to 500 feet
500 to 1000 feet
Above 1000 feet
SCALE OF MILES
WORCESTER
GLOUCESTER
OXFORD
BUCKINGHAM
NORTHAMPTON
BEDFORD
HERTFORD
CAMBRIDGE
SUFFOLK
ESSEX
MIDDLESEX
LONDON
BERKSHIRE
WILTSHIRE
HAMPSHIRE
SURREY
KENT
SALISBURY PLAIN
WHITE HORSE HILLS
CHILTERN HILLS
TEWKESBURY
FOREST RIDGES
RIVER THAMES
Worcester
Stratford on Avon
Evesham
Cheltenham
Gloucester
Cirencester
Tewkesbury
Stroud
Oxford
Witney
Chipping Norton
Bicester
Woodstock
Banbury
Buckingham
Aylesbury
Tring
Berkhamstead
Watford
Hemel Hempstead
Northampton
Towcester
Daventry
Wellingborough
Rugby
Bedford
Biggleswade
Ampthill
Woburn
Luton
Hitchin
Baldock
Royston
Cambridge
Shelford
Newport
Saffron Walden
Bishop's Stortford
Hertford
Hoddesdon
Ware
Epping
Harlow
Great Dunmow
Braintree
Halstead
Colchester
Sudbury
Ipswich
Chelmsford
Maldon
Southminster
Wickford
Southend
Romford
Enfield
Barnet
Edgware
Harrow
Hendon
Willesden
Ealing
Hounslow
Staines
Teddington
Kingston
Wimbledon
Croydon
Sutton
Greenwich
Woolwich
Dartford
Gravesend
Sheerness
Chatham
Rochester
Maidstone
Ashford
Tenterden
Hastings
Tunbridge Wells
Godstone
Reigate
Dorking
Guildford
Woking
Epsom
Knockholt
Sevenoaks
Basingstoke
Andover
Newbury
Reading
Wallingford
Henley
Marlborough
Swindon
Wantage
Abingdon
Faringdon
Chippenham
Calne
Devizes
Trowbridge
Pewsey
Salisbury
Amesbury
Stockbridge
Winchester
Alton
Farnham
Aldershot
Petersfield
Liss
Midhurst
Horsham
Arundel
Chichester
Portsmouth
Southampton
Lymington
Ringwood
Fordingbridge
Romsey
Tisbury
Shaftesbury
Sherborne
Yeovil
Crewkerne
Axminster
Lyme Regis
Bridport
Dorchester
Weymouth
Swanage
Wareham
Poole
Bournemouth
Christchurch
Lymington
Isle of Wight
Newport
Ryde
Cowes
Ventnor
Sandown
Shanklin
Freshwater
Yarmouth
Totland Bay
Bembridge
Brighstone
Brook
Niton
Blackgang Chine
St. Lawrence
Whitwell
Chale
Shorwell
Gatcombe
Carisbrooke
Newport
Cowes
Ryde
Sandown
Shanklin
Ventnor

THE WEATHER OF JANUARY.

THE flow of Atlantic depressions, which was in operation in December, continued throughout the first three weeks of January. The weather remained therefore in an exceedingly unsettled state, and, owing to a change in the tracks pursued by the various storm systems, its general character was of a more wintry type. In December the centres of depressions had kept as a rule outside our Atlantic seaboard, so that the winds in these islands were mostly from between south and west. In January the storm centres came more immediately over the country and the mild south-westerly wind was therefore interspersed not infrequently with cold winds from some northerly quarter. The most important depressions were those of the 1st, 2nd, the 6th and the 9th, the wind rising on each occasion to the force of a gale in many districts. On the 2nd, the westerly gusts blew with a velocity of 69 miles per hour, at Holyhead, and 85 miles at Southport; while on the 6th the wind exceeded a velocity of 65 miles in several parts of our west and south-west coasts, and reached 78 miles at Pendennis Castle (Falmouth). Between the 3rd and 4th heavy snowstorms were experienced in the west and north of England, causing, locally, considerable interruptions to traffic. During these three weeks of disturbed weather the mean temperature over England was slightly above the average, and no frosts of any great consequence were reported. In Scotland, the air was much colder, sharp frost occurring on the nights of the 6th, the 12th and the 18th; on the last-mentioned occasion the sheltered thermometer fell to 15°, at Balmoral, and 17°, at West Linton, and Eskdalemuir.

The cyclonic period ended between the 26th and 28th with the movement of a depression which came from Iceland and travelled in a south south-easterly direction across Great Britain and France. In its rear strong northerly winds set in, and, on the 27th, heavy snowstorms occurred in many districts, as far south as Hertfordshire. Sharp frost was experienced the same night in Scotland, the thermometer falling to 13° at West Linton and 14° at Kilmarnock. A large anticyclone now developed in the far north, its borders eventually spreading southwards over a large part of Great Britain. Cold winds from east or north-east therefore became general, with sharp wintry weather and occasional falls of snow in many English districts; on the 31st the temperature at a number of the inland stations failed to reach the freezing point all day.

Over the eastern half of the United Kingdom the total duration of bright sunshine was below the average, but in the west there was a fairly general excess. At Richmond (Kew Observatory), the aggregate was little more than half the amount at Bidston, and less than half the amount at Falmouth and Valencia (Cahirciveen).

The rainfall was generally above the average, the excess being most marked in the south-east of England, where more than twice the average amount fell over a wide area. The only appreciable deficiency occurred in the Scottish Highlands, where about 70 per cent. of the average fall was registered at many stations and only 57 per cent. at Fort William. The fall was normal in the south of Ireland, but above the average to the north of Munster. Less than 3 inches fell along the east coast of Great Britain from the Thames to the Firth of Fife, as well as in the extreme north of Scotland and in Dublin. The fall exceeded 6 inches in large areas in Sussex and Hampshire, in the mountains of Wales and Scotland, and in the south-west of Ireland. Part of the English Lake District had more than 10 inches.

The general rainfall expressed as a percentage of the average was :—England and Wales, 155; Scotland, 94; Ireland, 122; British Isles, 124.

In London (Camden Square) the mean temperature was 37°·8 or 0°·7 below the average. The duration of sunshine was 11·5 hours. The duration of rainfall, 89·7 hours, was the highest for January in the 39 years for which records have been kept. Only twice before, in 1912 and 1915, has rain fallen for more than 80 hours in January. There was no recorded evaporation during the month.

RAINFALL TABLE FOR JANUARY, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875–1909. in.	1918. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	Nos. of Day
Camden Square	*London*	1·83	3·22	+1·39	176	·41	27	22
Tenterden	*Kent*	2·14	4·93	+2·79	230	·84	10	23
Arundel (Patching)	*Sussex*	2·59	6·13	+3·54	236	·74	28	23
Fordingbridge (Oaklands)	*Hampshire*	2·67	5·99	+3·32	224	·92	3	24
Oxford (Magdalen College)	*Oxfordshire*	1·78	2·85	+1·07	160	·71	3	22
Wellingborough (Swanspool)	*Northampn*	1·90	3·76	+1·86	198	·77	3	23
Bury St. Edmunds (Westley)	*Suffolk*	1·70	2·67	+ ·97	157	·46	1	20
Geldeston [Beccles]	*Norfolk*	1·53	2·98	+1·45	195	·56	5	25
Polapit Tamar [Launceston]	*Devon*	3·59	6·46	+2·87	180	·81	6	25
Rousdon [Lyme Regis]	,,	2·94	5·37	+2·43	183	·76	19	22
Stroud (Field Place)	*Gloucester*	2·33	3·07	+ ·74	132	·79	15	12
Church Stretton (Wolstaston)	*Shropshire*	2·51	3·47	+ ·96	138	·47	1	21
Boston	*Lincoln*	1·54	2·94	+1·40	191	·48	3	24
Worksop (Hodsock Priory)	*Nottingham*	1·70	3·00	+1.30	177	·92	3	20
Mickleover Manor	*Derbyshire*	1·95	3·60	+1·65	185	1·10	3	20
Congleton (Buglawton Vic.)	*Cheshire*	2·26	2·92	+ ·66	129	·37	3	23
Southport (Hesketh Park)	*Lancashire*	2·55	4·17	+1·62	164	·45	1	23
Wetherby (Ribston Hall)	*York, W.R.*	1·89	3·37	+1·48	178	·73	4	15
Hull (Pearson Park)	,, *E.R.*	1·70	3·02	+1·32	178	·58	3	19
Newcastle (Town Moor)	*North'land*	1·90	2·89	+ ·99	152	·55	4	21
Borrowdale (Seathwaite)	*Cumberland*	13·44	13·00	— ·44	97	...	...	...
Cardiff (Ely)	*Glamorgan*	3·65	5·74	+2·09	157	·89	1	25
Haverfordwest	*Pembroke*	4·69	6·25	+1·56	133	·70	13	25
Aberystwyth (Gogerddan)	*Cardigan*	3·91	5·66	+1·75	145	·55	28	24
Llandudno	*Carnarvon*	2·51	2·76	+ ·25	110	·39	9	26
Cargen [Dumfries]	*Kirkcudbrt.*	4·10	4·01	— ·09	98	·65	2	23
Marchmont House	*Berwick*	2·40	4·06	+1·66	169	·81	4	21
Girvan (Pinmore)	*Ayr*	4·78	5·16	+ ·38	108	·85	2	27
Glasgow (Queen's Park)	*Renfrew*	3·53	3·59	+ ·06	102	·74	2	20
Islay (Eallabus)	*Argyll*	4·78	6·89	+2·11	144	1·08	1	26
Mull (Quinish)	,,	5·55	5·43	— ·12	98	·97	23	24
Loch Dhu	*Perth*	9·20	6.55	—2·65	71	·95	13	19
Dundee (Eastern Necropolis)	*Forfar*	2·01	2·60	+ ·59	129	·80	1	22
Braemar	*Aberdeen*	2·92	2·68	— ·24	92	...	...	...
Aberdeen (Cranford)	,,	2·36	3·29	+ ·93	140	·65	20	21
Gordon Castle	*Moray*	1·99	3·96	+1·97	199	...	...	...
Drumnadrochit	*Inverness*	3·63	2·73	— ·90	75	·40	4	22
Fort William	,,	9·20	5·22	—3·98	57	·70	13	19
Loch Torridon (Bendamph)	*Ross*	9·42	6·60	—2·82	70	1·09	25	21
Dunrobin Castle	*Sutherland*	2·75	1·98	— ·77	72	·30	16	13
Glanmire (Lota Lodge)	*Cork*	4·70	4·74	+ ·04	101	·84	6	22
Killarney (District Asylum)	*Kerry*	5·94	5·95	+ ·01	100	·62	13	27
Waterford (Brook Lodge)	*Waterford*	3·78	4.02	+ 24	106	·45	6	23
Nenagh (Castle Lough)	*Tipperary*	3·88	3·78	— ·10	97	·53	9	21
Ennistymon House	*Clare*	4·30	6.66	+2·36	155	·79	13	22
Gorey (Courtown House)	*Wexford*	3·19	4·52	+1·33	142	·49	4	22
Abbey Leix (Blandsfort)	*Queen's Co.*	3·15	...	...	...	...	...	...
Dublin (Fitz William Square)	*Dublin*	2·14	2·64	+ ·50	123	·34	4	25
Mullingar (Belvedere)	*Westmeath*	3·10	3·71	+ ·61	120	·50	17	20
Crossmolina (Enniscoe)	*Mayo*	5·35	6·80	+1·45	127	·98	13	27
Cong (The Glebe)	,,	4·79	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	3·87	5·31	+1·44	137	·72	13	25
Seaforde	*Down*	3·41	4·49	+1·08	132	62	7	24
Ballymena (Harryville)	*Antrim*	3·73	4·87	+1·14	131	·70	13	26
Omagh (Edenfel)	*Tyrone*	3·46	4·63	+1·17	134	.80	13	21

SUPPLEMENTARY RAINFALL, JANUARY, 1919.

Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	4·65
,,	Ramsgate	2·55
,,	Hailsham	5·98
,,	Totland Bay, Aston House...	4·81
,,	Stockbridge, Ashley..	4·82
,,	Grayshott	6·56
,,	Upton Nervet	3·62
III.	Harrow Weald, Hill House...	3·93
,,	Pitsford, Sedgebrook	3·68
,,	Woburn, Milton Bryant	3·95
,,	Chatteris, The Priory	2·57
IV.	Elsenham, Gaunts End	3·22
,,	Shoeburyness	...
,,	Colchester, Hill Ho., Lexden	2·35
,,	Aylsham, Rippon Hall	2·88
,,	Swaffham	3·08
V.	Bishops Cannings	4·12
,,	Weymouth	5·49
,,	Ashburton, Druid House	8·98
,,	Cullompton	6·00
,,	Lynmouth, Rock House	6·17
,,	Okehampton, Oaklands	6·59
,,	Hartland Abbey	5·28
,,	St. Austell, Trevarna	6·83
,,	North Cadbury Rectory	4·91
VI.	Clifton, Stoke Bishop	4·75
,,	Ledbury, Underdown	3·15
,,	Shifnal, Hatton Grange	2·59
,,	Droitwich	3·27
,,	Blockley, Upton Wold	4·75
VII.	Grantham, Saltersford	3·47
,,	Louth Westgate	3·43
,,	Bawtry, Hesley Hall	2·82
,,	Derby, Midland Railway	3·17
VIII.	Nantwich, Dorfold Hall	2·04
,,	Bolton, Queen's Park	4·70
,,	Lancaster, Strathspey	4·99
IX.	Langsett Moor, Up. Midhope	5·04
,,	West Witton	4·84
,,	Scarborough, Scalby	3·44
,,	Ingleby Greenhow	3·61
,,	Mickleton	2·90
X.	Bellingham, High Green Manor	3·98
,,	Ilderton, Lilburn Cottage	3·64
,,	Keswick, The Bank	5·69
XI.	Orton	7·05
,,	Llanfrechfa Grange	6·22
,,	Treherbert, Tyn-y-waun	11·71
,,	Carmarthen, The Friary	6·68
,,	Fishguard, Goodwick Station.	5·53
,,	Crickhowell, Tal-y-maes	7·50
,,	Birmingham WW., Tyrmynydd	6·54
,,	Lake Vyrnwy	8·43
,,	Llangynhafal, Plas Drâw	2·93
,,	Rhiwbryfdir	8·06
,,	Dolgelly, Bryntirion	5·68
XI.	Lligwy	4·34
,,	Douglas, Isle of Man	5·27
XII.	Stoneykirk, Ardwell House...	4·53
,,	Carsphairn, Shiel	7·11
,,	Langholm, Drove Road	5·57
XIII.	Selkirk, The Hangingshaw..	3·67
,,	North Berwick Reservoir	3·55
,,	Edinburgh, Royal Observaty.	2·06
XIV.	Biggar	3·00
,,	Maybole, Knockdon Farm	3·72
XV.	Ardgour House	7·12
,,	Shiskine	5·36
,,	Oban	4·46
,,	Holy Loch, Ardnadam	7·13
,,	Loch Venachar	5·95
XVI.	Glenquey	5·40
,,	Loch Rannoch, Dall	4·00
,,	Blair Atholl	2·31
,,	Coupar Angus	2·94
,,	Montrose, Sunnyside Asylum.	3·23
XVII.	Balmoral	3·23
,,	Fyvie Castle	3·68
,,	Keith Station	5·89
XVIII.	Rothiemurchus	2·79
,,	Loch Quoich, Loan	11·45
,,	Skye, Dunvegan	6·28
,,	Fortrose	1·72
,,	Glencarron Lodge	5·23
XIX.	Tongue Manse	2·49
,,	Melvich	2·39
,,	Loch More, Achfary	5·84
XX.	Dunmanway, The Rectory	6·44
,,	Mitchelstown Castle	6·02
,,	Gearahameen	10·70
,,	Darrynane Abbey	8·16
,,	Clonmel, Bruce Villa	4·63
,,	Roscrea Timoney Park	3·40
,,	Broadford, Hurdlestown	4·88
XXI.	Enniscorthy, Ballyhyland...	5·23
,,	Rathnew, Clonmannon	3·60
,,	Hacketstown Rectory	4·49
,,	Ballycumber, Moorock Lodge	3·11
,,	Balbriggan, Ardgillan	2·89
,,	Castle Forbes Gardens	3·78
XXII.	Ballynahinch Castle	7·37
,,	Woodlawn	2·17
,,	Westport House	5·59
,,	Dugort, Slievemore Hotel	7·50
XXIII.	Enniskillen, Portora	5·45
,,	Dartrey [Cootehill]	3·98
,,	Warrenpoint, Manor House	3·98
,,	Belfast, Cave Hill Road	4·65
,,	Glenarm Castle	4·78
,,	Londonderry, Creggan Res...	4·22
,,	Milford House	4·09
,,	Killybegs	5·61

Climatological Table for the British Empire, August, 1918.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp.	Minimum. Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	89·7	22	46·9	30	74·1	54·2	54·7	71	100·5	47·3	1·78	12	6·6
Lagos	85·2	26	69·0	12	82·5	72·2	70·9	79	145·0	64·0	1·32	10	7·3
Cape Town	91·2	24	42·8	1	71·3	51·3	49·7	65	...	...	·22	4	2·8
Johannesburg	71·0	20	33·3	2	60·7	41·3	34·6	65	...	31·0	3·66	6	3·2
Bloemfontein	73·5	20	26·9	15	64·5	35·9	39·6	73	...	...	1·82	4	2·1
Calcutta...	91·6	1	75·1	9	88·4	78·8	78·0	87	...	72·9	10·77	16	4·0
Madras	104·1	4	74·8	11	97·3	73·9	66·0	71	164·1	71·7	3·06	12	6·4
Colombo, Ceylon ...	86·8	3	73·5	5	85·6	77·2	72·8	79	155·4	70·8	2·09	18	8·6
Hongkong	87·1	25	74·0	3	83·6	76·4	74·8	86	...	...	29·23	20	8·1
Sydney	75·9	29	42·9	27	65·5	48·8	47·8	75	125·0	36·0	2·51	...	5·6
Melbourne	65·1	21	34·1	1	59·9	45·3	44·5	73	120·8	25·6	2·73	17	6·6
Adelaide	69·0	4	36·6	2	61·7	46·1	46·0	74	126·5	28·6	2·63	14	5·6
Coolgardie	77·0	25	35·5	8	63·6	43·4	40·5	58	140·0	30·0	·67	5	5·9
Brisbane	78·0	29	45·5	13	72·1	51·1	50·4	66	134·6	40·1	1·24	11	3·5
Hobart, Tasmania ..	64·4	27	35·9	20	56·3	43·8	40·0	66	118·6	31·2	3·53	14	6·3
Wellington ...	62·7	3	30·5	11	54·9	43·3	41·7	75	124·0	20·6	3·51	13	5·9
Jamaica, Kingston ..	94·2	2, 28	69·8	5	90·1	73·6	71·6	77	...	...	2·87	4	4·0
Grenada	84·0	15	71·0	15*a*	86·0	75·0	...	76	138·0	...	6·55	16	3·5
Toronto	102·2	13	47·8	1	81·7	59·6	61·0	79	160·0	42·5	4·15	11	4·4
Fredericton	86·5	24	39·0	19	74·2	50·3	54·7	74	...	...	1·05	10	4·5
St. John, N.B. ...	79·2	20	46·5	28	66·0	53·1	52·3	80	137·0	39·5	1·98	11	8·8
Victoria, B.C.	80·0	30	48·8	27	67·0	51·9	53·0	82	140·4	39·8	1·78	14	4·2

a—19.

Johannesburg.—Bright sunshine 240·7 hours.

COLOMBO, CEYLON.—Mean temp. 81°·4, or 0°·2 above, dew point 0°·7 below, and R ·54 in. below, averages. Mean hourly velocity of wind 6·3 miles.

HONGKONG.—Mean temp. 79°·5. Bright sunshine 136·7 hours. Mean hourly velocity of wind 12·0 miles.

Melbourne.—Mean temp. one of the highest for past years, and R ·92 in. above average.

Adelaide.—Mean temp. equal to, and R ·13 in. above, averages.

Coolgardie.—Temp. 0°·1 below, and R ·25 in. below, averages.

Brisbane.—Temp. 0°·4 above, and R ·99 in. below, averages. Fog on 15 days.

Wellington.—Mean temp. 0°·7 above, and R 1·06 in. below, averages. Bright sunshine, 149·4 hours.

Symons's
Meteorological Magazine.

No. 638. MARCH, 1919. Vol. LIV.

Capt. Melville Willis Campbell Hepworth, C.B., R.D., R.N.R.

Cheltenham, 27th April, 1849—Ealing, 25th February, 1919.

The death of Captain Campbell Hepworth, following so soon after that of Mr. Allingham, is a serious loss to the Marine Division of the Meteorological Office, of which he had been Superintendent since 1899. Captain Hepworth was a son of the Rev. Robert Hepworth, of Cheltenham, and entered the merchant service. He had experience also in the Indian Marine and as a Naval Reserve officer in the Royal Navy. He was always keenly interested in the scientific as well as in the professional aspects of a sea-faring life, and when in command of liners on the Australian passage, both by the Suez Canal route and between Sydney and Vancouver, he made valuable observations on meteorology and currents. His appointment to the Marine Branch of the Meteorological Office gave him a welcome opportunity for encouraging meteorological observations at sea, and he was indefatigable in working up and publishing the results of the increasing number of well-kept meteorological logs. Amongst the very numerous publications of the Meteorological Office issued under his superintendence none owed more to his personal initiation and impetus than the monthly or quarterly pilot-charts of the oceans, showing the average conditions of weather, ocean-currents, and floating ice. Apart from the usefulness of these charts to the careful mariner, they served as fascinating companions for the scientific passenger and we have often been struck when at sea with the remarkable accuracy of the charts in fixing the positions of the limits of the trade winds at different seasons.

Captain Hepworth was engaged officially in many interesting pieces of oceanographical discussion, amongst which may be mentioned the surface isotherms of the Southern Ocean and the investigation of the ice drifts in the North Atlantic. More purely meteorological were his "Barometer Manual for the use of Seaman," and his "Seaman's Handbook of Meteorology." Almost his last work was the encouragement of rainfall observations at sea, and the

introduction on the back of the Monthly Pilot Charts of tables of rainfall from ship's logs.

Captain Hepworth communicated many valuable papers to different scientific and professional societies during the last thirty-five years, and an interesting selection of these was published in 1907 under the title of "Notes on Maritime Meteorology." The first paper in that volume is a lecture delivered to the United Service Institution in 1896, on "Meteorology: a factor in Naval Warfare," showing that Captain Hepworth took his naval responsibilities no less seriously than his nautical and scientific duties.

As a colleague Captain Hepworth was helpful and considerate, while his retiring and kindly disposition endeared him to innumerable friends afloat and ashore.

THE CARE OF THE BAROGRAPH.

Hints to Amateurs.

By Lieut. A. S. Martin-Smith.

I suppose that a considerable number of people include a barometer in the list of items, useful or otherwise, but generally considered necessary, to complete the equipment of the average home. Undoubtedly the primary consideration is very often not so much a question of its practical utility, but rather of its being a conventional article of furniture which is more or less ornamental, and at the same time, it is hoped, will convey to one's friends that which is not otherwise obvious, namely a suggestion of learning or at least of an interest in things scientific.

It also serves as a direct encouragement, if, indeed, such be necessary, to introduce as a topic of conversation that subject about which the man in the street is never tired of exposing his profound ignorance.

In most cases no effort is made to get the best out of the household barometer, and especially is this the case with the self-recording variety; and a casual glance into the windows of the shops of most opticians will show that insufficient care seems to be taken by even the very people whose business it is to exhibit them for sale.

I am not, however, concerned here with these people, but rather with the private individual who really does take an intelligent interest and a certain amount of justifiable pride in his barograms. which could be, but rarely are, made use of in investigations. I invite such a person to examine his records and ask himself whether or no his traces are as near perfection as the limitations of his instrument will permit.

In any investigation of line squalls or similar phenomena, an

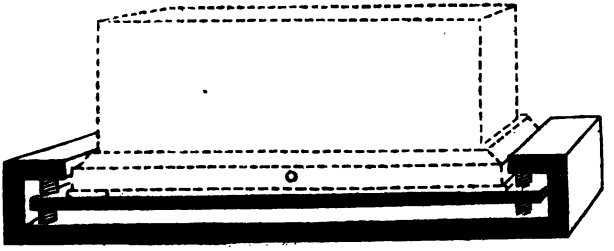
examination of barograms should disclose well-defined sudden oscillations in the trace at or about the time of the occurrence. Unless the instrument receives judicious treatment and adjustment and is carefully timed, the records will prove of little or no value for future reference in such cases.

It is quite a simple matter to ink the pen-nib properly and not a very difficult operation to reduce to a minimum the pressure of the pen against the paper, yet how seldom is this done. Perhaps it would be the lesser evil to underestimate the quantity of ink required and to err on the side of having too slight a contact of pen with paper.

One frequently finds blurred traces caused by a faulty pen; and sometimes a succession of vertical intervals is the only indication of what in reality should be represented by a continuous curve. This is due to an excess of friction which prevents any movement of the pen when it proves stronger than the impulse created by the compression or otherwise of the vacuum chambers.

Granted, however, every care has been taken in these details, there is still a difficulty to be overcome.

There is the question of jolts and jars due to irrepressible domestic activity and careless shutting of doors and shaking of floors inseparable from most houses, this in addition to occasional accidental jostling of the instrument itself. To eliminate, or, at least, modify



this disturbing effect, some years ago, I constructed a simple shock-absorbing contrivance which has certainly answered the purpose very well indeed. The barograph is placed upon a wooden platform which is supported above and below, at both ends, by spiral springs, borrowed from some spring dumb-bells, as shown in the accompanying illustration.

The principle is not new, but I have not heard of its application in this direction and can recommend its use to those in similar circumstances who desire to obtain the best results from what for the individual can prove to be for practical purposes the most interesting and useful of all meteorological instruments.

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society was held on Wednesday February 19th, at 70, Victoria Street, S.W., Sir Napier Shaw, F.R.S., President, in the Chair.

Dr. S. Chapman read a paper on "The lunar tide in the Earth's atmosphere." The lunar tidal variation of barometric pressure had been well determined at Batavia, from fifty years' hourly records, and from data extending over about five years in each case at St. Helena, Singapore, Rome and Samoa. As very little was known about its dependence on latitude, season, and the distance, declination and phase of the moon, a new and detailed discussion has been made of thirty and twenty-eight years' records of barometric pressure at Batavia and Hong Kong, respectively. The results were considered alongside the pre-existing values from the stations above-named, together with the Greenwich determination recently published in in the *Quarterly Journal* of the Royal Meteorological Society. The amplitude varies approximately as the fourth power of the cosine of the latitude, while the phase varies somewhat irregularly from 33° (Samoa) to 114° (Greenwich), where 90° corresponds to the occurrence of maximum pressure when the moon is on the meridian. No dependence on lunar phase or declination was detected, while as regards the moon's distance, an increase of amplitude from apogee to perigee was observable, though less than the increase in the tide-producing force. Distinct evidence of a seasonal variation of amplitude and phase was shown by both the Hong Kong and Batavia determinations. The conclusion was that the lunar atmospheric tide is not a simple tidal phenomenon, but is complicated by other effects, notably by resonance with an adjacent free period of vibration of the atmosphere, and possibly also by more local causes, such as the rise and fall of the ocean.

Major G. I. Taylor spoke on the effect of resonance and the wind variations due to variations in pressure. Mr. E. C. Barton, Mr. W. W. Bryant and Mr. F. J. W. Whipple also took part in the discussion.

Mr. Miller Christy read a paper, entitled, "The Gunfire on the Continent during 1918: its audibility at Chignal St. James, near Chelmsford." Observations on the audibility of the continental gunfire have been made by the author for four years. The results for previous years were brought forward in earlier papers. In 1918 the first sounds were heard on the evening of May 8th and the last on August 26th, thus confirming previous experience that there is audibility at the writer's post of observation in Essex only during the summer months. The period of audibility in 1918 amounted to 15 weeks, 5 days. In previous years the periods were: 1915, 17 weeks, 3 days; 1916, 15 weeks; 1917, 19 weeks, 4 days. The

average for the four years is 17 weeks. A feature of 1918 was that the sounds were less loud and distinct than in previous years, and there were none of the periods of extreme loudness which had before been noticed.

Mr. J. E. Clark said that at Purley he heard distant gunfire on 48 days, between May 31st and August 25th. It was heard daily from July 25th to August 11th. Mr. E. C. Barton quoted from a report of a bombardment in Upper Alsace on January 21st, 1917, which was audible on the slopes of the Jura and in Switzerland. Atmospheric conditions seemed to be important for the air was clear where firing was heard and foggy where it was not heard.

Mr. Miller Christy also contributed some notes on two whirlwinds in Essex. On October 27th, 1916, the village of Writtle suffered damage to the extent of £3,000 to £4,000, and thousands of oaks and elms were badly damaged. On July 27th, 1918, the parish of Gosfield suffered, though damage was less severe, the track of the whirl being mostly in open country. Major Blair said the great storms of the United States were similar though of longer duration. The sharply defined and narrow track of the storm was also characteristic.

The following candidates were balloted for and elected Fellows of the Society :—Capt. K. G. Stacy Hatfield, G. C. Singleton, Donald Stevenson, Adolph Zaiman.

Correspondence.

To the Editor of Symons's Meteorological Magazine

MILD WINTER IN THE EASTERN UNITED STATES.

Up to the present the winter in this vicinity and generally in the eastern part of the country has been one of the mildest in many years. It has been a vivid and delightful contrast to that of 1917-1918, which was one of great severity, with heavy and continued snowfalls. So far I have measured only three-quarters of an inch of snow, while at the same period last year more than twenty inches had fallen. There have been no important storms, the depressions of the barometer being insignificant. Temperature has averaged well above the normal, the lowest minimum 9° against 5° below zero last year. January was genial, almost balmy, yet in Alaska great cold was experienced, temperature sinking to 62° below zero.

CHARLES DECKER.

Narberth, Pa., U.S.A., February 5th, 1919.

AN OLD WEATHER RECORD.

THE enclosed extract relates to the year 1667 :—

"Whereas upon the Thirteenth Day of October last, Between The hours of three and Four in the Afternoon it pleased the Lord to Viset the Town of Welbourn with a sad and Dreadfull Judgment, there was Thunder hail-stones as big as Pigeons Eggs. Congealed and Sharp pointed and some smart Cracks there was A Continued thunder for about a Quarter of an hour together And a tedious Dismal Storm Ensued that in Less then Four Minutes blew Down four and fourty Dwelling houses, as also their Barns Stables and hovels and Stacks and That which remained Spoiled with Rain that fell upon It before it Could Possibly be Gathered togather. The Werlwind Carried the Breadth of a Eleven or Twelve Score yards. it had the Appearance of fire and a Sulphruas smell the Day wonder Full Dark and throw houses trees into all Quarters East West North and South. It pleased God to Spare their Lives but only one Youth that was Slain. The Close as above Mentioned as appears unto us by Certificate Subscribed by The Hands of Tho. Lumb John Rafer and Willm. Glascow who was appointed to Vew the same amounting to the value of Six hundred pounds fourteen Shillins."

The above describes a storm at Welbourn, in Lincolnshire. One of the chief occupiers was a George Blaney, amongst whose papers I have found this account. The Blaneys are ancestors of my paternal grandmother, and as I have many of their papers there seems no reason to doubt the genuiness of the above account.

Colmer Rectory, Alton, Hants., Jan. 27th, 1919. A. C. HERVEY.

REMARKABLE UNIFORMITY OF TEMPERATURE.

MR. H. K. G. ROGERS has drawn attention to the low range of temperature during the ten days, January 28th to February 6th, and it may be of some interest to compare with his result the figures for Headley, near Epsom about 575 ft. above sea-level.

		Max.	Min.			Max.	Min.
January	28th	32°·5	30°·9	February	2nd	29°·8	27°·7
,,	29th	33°·8	29°·0	,,	3rd	30°·8	28°·1
,,	30th	29°·2	29°·0	,,	4th	34°·8	28°·6
,,	31st	27°·8	24°·1	,,	5th	33°·4	29°·2
February	1st	30°·9	24°·8	,,	6th	35°·0	30°·3

Mean at Weybridge.
33°·8 Max. 29°·4 Min. 4°·4 Range.

Mean at Headley.
31°·8 Max. 28°·2 Min. 3°·9 Range.

An interesting point which I have long noted in cloudy weather of the north-easterly type, when the temperature range is small, is the marked frequency with which the maximum occurs at night. This happened here on no less than four out of the ten nights under review, viz., on January 29th, 31st, February 1st and 6th.

THEODORE E. R. PHILLIPS.

Headley Rectory, Epsom.

SNOWSTORM OF JANUARY 4th AND 5th.

WITH reference to my suggestion in the February number of "altitudinal outliers" of the snowfall in Kent, Surrey, and Sussex, I should be much interested to know whether Observers in those counties within sight of elevated tracts like the North and South Downs, Ashdown Forest, Leith Hill or Hindhead, noted any snow lying on the higher ground on the dates in question. I would like while writing to draw attention to an error in the fourth line of my letter in the February number, which resulted in the printing of north-west instead of south-west. I am particularly sorry about this because there is a great difference between the characteristic temperature of a W. and a S.W. wind in these islands, and a N.W. wind, taking the year through is, together with a N. wind, the coldest, being in summer cooler than N.E.

L. C. W. BONACINA.

Hampstead, March 2nd, 1919.

[Mr. D. W. Horner writes, in reference to the snowstorm of January 4th and 5th, that at Moretonhampstead, on the borders of Dartmoor, snow fell to a depth of 6 inches before 9 a.m. on the 5th, yielding ·68 in. in the rain gauge. The height above sea-level is 642 ft. At Ipplepen (273 ft.) there was no snow, only rain and sleet, ·96 in. being measured.—ED., *S.M.M.*]

WEATHER MAPS IN NEWSPAPERS.

WITH regard to your very interesting article on the above subject, may I point out that although it was *The Times* that inaugurated the daily weather map in newspapers in 1875, it was to the enterprise of the *Daily News* that a system of telegraphic and railway weather reports was started as far back as 1849. May it not truly be said that these reports from various stations were the pioneers of the present-day weather map, or synoptic chart?

In connection with the fact that the *Morning Post* has now followed the example of *The Times* in reproducing a daily weather chart, it may be recalled that previous to the war the only other newspaper to emulate *The Times* was the short-lived *Tribune*, which used to print a weather map on the lines of those supplied to American newspapers by the United States Weather Bureau.

D. W. HORNER, F.R.Met.Soc.

Moretonhampstead, Devon, February 20th, 1919.

[The *Daily Telegraph* has now to be added to the list of daily papers issuing the 6 p.m. Meteorological Office Weather Map, covering the breadth of two columns. *The Times* has diminished the scale of its Weather Map to the breadth of one column, with some loss of distinctness.—ED., *S.M.M.*]

SNOW FOLLOWING FINE WEATHER.

SUNDAY, March 2nd, was a glorious soft warm sunny day, a striking contrast to the previous weather. From observation of similar occurrences in previous years at this season I forecasted snow in three days. This came to-day, March 5th, when snow fell heavily for some hours in the afternoon. What is the explanation?

CHARLES P. HOOKER, F.R.Met.Soc.

Cirencester, March 5th, 1919.

WIND BACKING ROUND THE COMPASS.

ON January 8th, at 8 a.m., the wind was due S., at 8.30 it had backed to S.E., and I expected heavy rain from a depression passing to the south, but only a few hundredths of fine rain fell. The wind continued to back, and at 10 a.m. was E., at noon, N.E., at 1 p.m., N., and at 2 p.m. W. There was a calm all this time, but much gloom with cloud level 600-700 feet. There was a clearance from the W. at 2 p.m. and some sun afterwards, but no wind. At 5 p.m. it had gone to S.W., and at 7.30 p.m. it was back once more at due S. and freshening. I conclude this shift of wind all round the compass in less than twelve hours was due to a very shallow disturbance surrounded by deep ones. There was no fall of barometer, only a temporary cessation in its rise. At 10.30 p.m. heavy rain set in with a freshening southerly wind and falling barometer.

R. P. DANSEY.

Kentchurch Rectory, Hereford, January 9th, 1919.

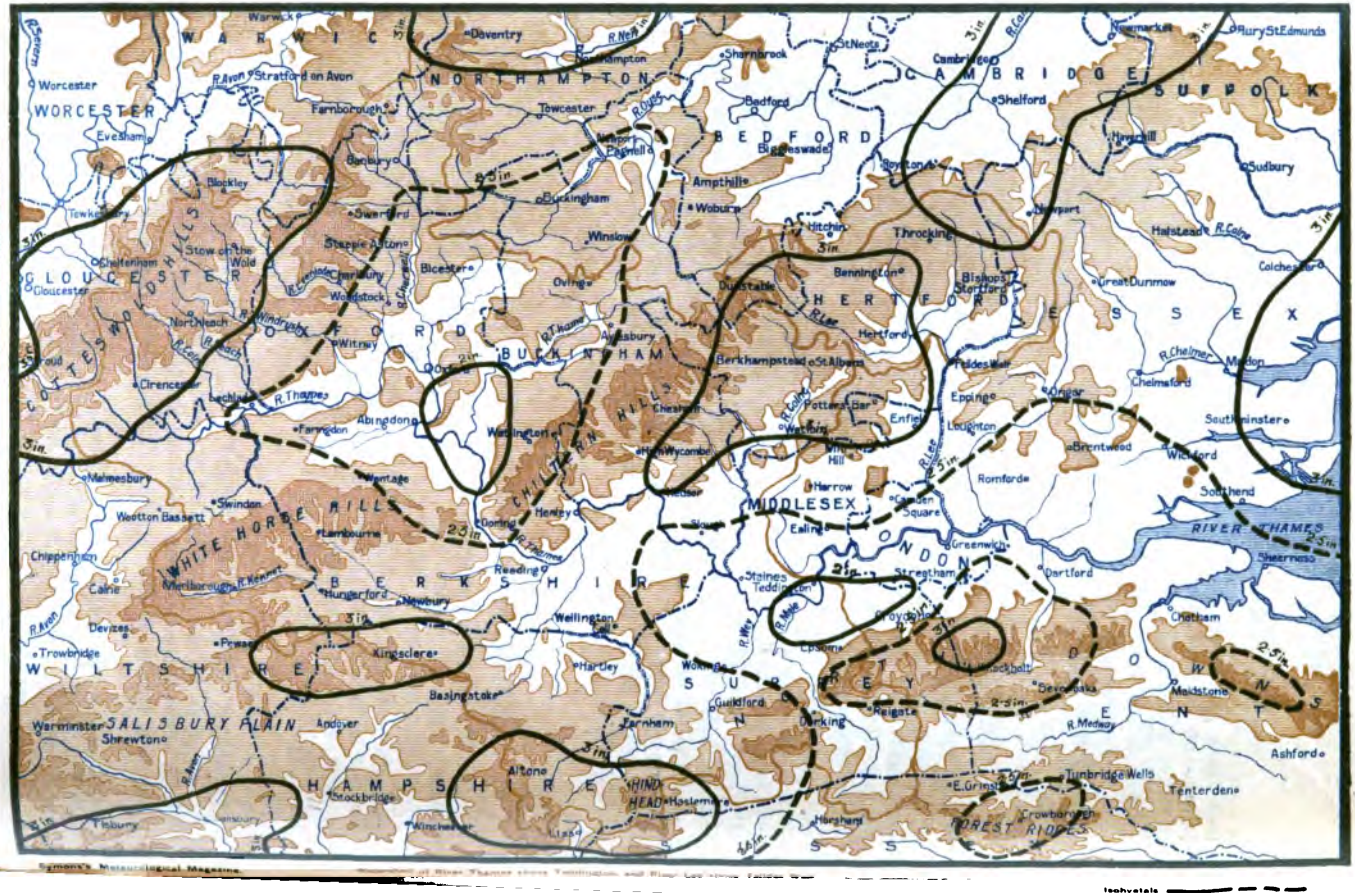
METEOROLOGICAL NEWS AND NOTES.

THE MUNSTER RAINFALL ASSOCIATION, founded by Mr. E. W. M. Murphy, of Cashel, co. Tipperary, has issued its first annual report, dealing with the rainfall of 1918. Records are given for the province of Munster and the adjoining counties, but the primary object of the Association is the encouragement of rainfall observing in Ireland generally, and we are glad to hear that a promising start has been made in the directon of securing the establishment of new stations.

ACTIVITY in establishing new rainfall stations is also manifesting itself in Wales, where the matter is being taken up by many of the County Councils, the observations being made in most cases at the schools. This is an example which we hope will be widely followed.

ERRATA.—In this Magazine for February, 1919, p. 3, the following corrections are required in Mr. Bonacina's letter on the Snowstorm of January 4th and 5th. Line 4, *for* north-west *read* south-west. Line 9, *for* night *read* right. Lines 20 and 26, *for* outlines *read* outliers.

THAMES VALLEY RAINFALL FEBRUARY, 1915.


ALTITUDE SCALE
Below 250 feet
250 to 500 feet
500 to 1000 feet
Above 1000 ft.
SCALE OF MILES
Warwick
Daventry
Worcester
Stratford on Avon
WORCESTER
NORTHAMPTON
Towcester
Farnborough
Evesham
Banbury
Blockley
Buckingham
Ampthill
Woburn
Winslow
Hitchin
Throcking
Bedford
Biggleswade
Sandy
Shefford
Newmarket
Bury St Edmunds
Sudbury
Haverhill
Halstead
Colchester
Great Dunmow
Bishop's Stortford
Hertford
Berkhampstead
St Albans
Tring
Dunstable
Leighton Buzzard
Stow on the Wold
Cheltenham
Gloucester
Cirencester
Tetbury
Malmesbury
Swindon
Wootton Bassett
Chippenham
Calne
Devizes
Trowbridge
Warminster
Shrewton
Andover
Basingstoke
Kingsclere
Newbury
Hungerford
Lambourne
Wantage
Abingdon
Farringdon
Witney
Oxford
Bicester
Chesham
High Wycombe
Aylesbury
Watford
Harrow
Hendon
Ealing
Kew
Staines
Teddington
Reading
Wokingham
Guildford
Woking
Dorking
Reigate
Epsom
Croydon
Streatham
Greenwich
Dartford
Romford
Epping
Enfield
Potters Bar
Brentwood
Chelmsford
Maldon
Southminster
Southend
Sheerness
Chatham
Maidstone
Ashford
Tenterden
Tunbridge Wells
Crowborough
Horsham
Petersfield
Alton
Winchester
Salisbury
Tisbury
Shaftesbury
Blandford
Wimborne
Ringwood
Lymington
Fordingbridge
Romsey
Eastleigh
Southampton
Portsmouth
Isle of Wight
Newport
Ryde
Cowes
Sandown
Shanklin
Ventnor
Yarmouth
Lymington
Christchurch
Bournemouth
Poole
Swanage
Wareham
Dorchester
Weymouth
Bridport
Lyme Regis
Axminster
Honiton
Sidmouth
Exmouth
Exeter
Crediton
Okehampton
Tiverton
Bampton
Barnstaple
Ilfracombe
Lynton
Minehead
Dulverton
Wellington
Taunton
Chard
Ilminster
Yeovil
Sherborne
Shaftesbury
Gillingham
Wincanton
Frome
Warminster
Trowbridge
Devizes
Marlborough
Swindon
Cirencester
Stroud
Gloucester
Tewkesbury
Evesham
Worcester
Malvern
Ledbury
Hereford
Ross
Monmouth
Chepstow
Newport
Cardiff
Penarth
Barry
Bridgend
Port Talbot
Neath
Swansea
Llanelly
Carmarthen
Haverfordwest
Pembroke
Tenby
Milford Haven
Fishguard
Cardigan
Aberystwyth
Machynlleth
Dolgelley
Barmouth
Pwllheli
Portmadoc
Criccieth
Caernarvon
Bangor
Llandudno
Colwyn Bay
Rhyl
Denbigh
Ruthin
Mold
Flint
Chester
Wrexham
Oswestry
Shrewsbury
Ludlow
Bridgnorth
Kidderminster
Stourbridge
Dudley
Wolverhampton
Walsall
Birmingham
Coventry
Nuneaton
Tamworth
Lichfield
Rugeley
Stafford
Newcastle
Hanley
Stoke
Leek
Buxton
Macclesfield
Congleton
Crewe
Nantwich
Whitchurch
Market Drayton
Newport
Wellington
Shifnal
Bridgnorth
Kidderminster
Worcester
Malvern
Ledbury
Hereford
Ross
Monmouth
Abergavenny
Merthyr Tydfil
Aberdare
Pontypridd
Llantrisant
Cowbridge

THE WEATHER OF FEBRUARY.

A SHORT spell of cold easterly winds at the beginning of the month (a legacy from January) was followed on Febuary 4th by the arrival of a cyclonic disturbance off the Irish coasts. Over a large portion of the country the wind therefore veered temporarily to the southward, and between the 5th and 7th the thermometer in most of the western districts rose above 50°, a reading as high as 56° being recorded at Killarney. On the 6th. the formation of a small secondary disturbance near the mouth of the English Channel was attended by heavy rain in Devon and Cornwall, the system afterwards moving south-eastwards across France to the Mediterranean.

A large anticyclone now began to extend from Northern Europe, and between about the 7th and 13th practically the whole of Great Britain was under the influence of a frost, which in spite of its comparative brevity, was sufficiently severe to permit of the indulgence of skating in nearly all districts. The lowest temperatures were observed between the 8th and 11th, when the sheltered thermometer fell below 20° at nearly all inland stations, a reading as low as 5° being recorded at West Linton, and a reading of 9° at Raunds. On the surface of the grass the thermometer naturally went a few degrees lower, and at Hemel Hempstead, early on the 9th, it touched zero Fahr. In several places there were three or four consecutive days upon which the thermometer in the screen failed to reach the freezing point all day. A good deal of night and morning fog was experienced at the time over eastern and central England, but with those exceptions the weather was exceedingly fine. the total duration of bright sunshine in the week ended the 15th being equal to considerably more than half the possible at many coast stations in the west and south. In the north the air was sometimes exceedingly dry; at Eskdalemuir the relative humidity on the 9th and 10th sank respectively to a minimum of 17 per cent. and 18 per cent.

During the latter half of the month the weather was influenced for the most part by depressions which advanced eastwards over the southern half of the United Kingdom. In the north, where the wind was usually from some easterly quarter, the weather remained essentially wintry, sharp frosts being experienced in Scotland about the nights of the 17th and 27ths. Further south the wind was more variable, but even there the thermometer seldom reached its average level, snow being experienced in nearly all parts of the kingdom between the 16th and 18th, and again in many northern and central districts, between the 26th and 28th.

Bright sunshine exceeded the average in many western districts but was below it in the east; at Kew Observatory the total duration for the month amounted to little more than half the usual February allowance. On the night of the 27th a brillant display of aurora was observed in nearly all the western and northern districts, and on the following night it was again seen in Scotland.

The rainfall was above the average over the greater part of England and Wales, except in the north-west, and below the average over Scotland and Ireland. In the south and east of England some stations had nearly twice the average fall. The deficiency was most marked in the English Lake District and in the normally rainy areas of Scotland. The total was less than 4 inches over the whole of Great Britain except South Wales, Devon and Cornwall. North of a line joining the Mersey and the Wash, it was less than 2 inches, except at a few scattered stations where this amount was slightly exceeded. Many stations in the north-east of Ireland had less than an inch of rain, and 3 inches was only exceeded in the south and west. The general rainfall expressed as as a percentage of the average was:—England and Wales, 103; Scotland, 38; Ireland, 69; British Isles, 71.

In London (Camden Square), the mean temperature was 35°·6 being 4°·1 below the average, and 2°·2 lower than in January. The duration of sunshine was 11·3 hours, and of rain, 71·3 hours. Evaporation ·13 inch.

RAINFALL TABLE FOR FEBRUARY, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875–1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	Nos. of Day
Camden Square	*London*	1·66	2·64	+ ·98	159	·64	16	14
Tenterden	*Kent*	1·90	2·30	+ ·40	121	·53	16	16
Arundel (Patching)	*Sussex*	2·17	2·77	+ ·60	128	·60	19	11
Fordingbridge (Oaklands)	*Hampshire*	2·34	3·23	+ ·89	138	·95	16	17
Oxford (Magdalen College)	*Oxfordshire*	1·62	2·10	+ ·48	130	·69	16	14
Wellingborough (Swanspool)	*Northampn*	1·70	2·43	+ ·73	143	·82	16	12
Bury St. Edmunds (Westley)	*Suffolk*	1·59	2·97	+1·38	186	·76	17	12
Geldeston [Beccles]	*Norfolk*	1·41	2·07	+ ·66	147	·60	16	16
Polapit Tamar [Launceston]	*Devon*	2·95	3·35	+ ·40	114	·70	16	15
Rousdon [Lyme Regis]	,,	2·50	4·58	+2·08	183	1·08	16	13
Stroud (Field Place)	*Gloucester*	2·12	2·88	+ ·76	136	·91	14	...
Church Stretton (Wolstaston)	*Shropshire*	2·17	...	...	...	...	...	...
Boston	*Lincoln*	1·53	2·40	+ ·87	157	1·00	16	11
Worksop (Hodsock Priory)	*Nottingham*	1·64	2·63	+ ·99	160	·93	16	12
Mickleover Manor	*Derbyshire*	1·71	2·22	+ .51	130	·52	17	9
Congleton (Buglawton Vic.)	*Cheshire*	1·95	·91	—1·04	47	·26	21	11
Southport (Hesketh Park)	*Lancashire*	2·07	1·10	— ·97	53	·50	19	8
Wetherby (Ribston Hall)	*York, W.R.*	1·71	1·55	— ·16	91	·53	16	8
Hull (Pearson Park)	,, *E.R.*	1·78	1·91	+ ·13	107	·73	16	14
Newcastle (Town Moor)	*North'land*	1·63	2·22	+ ·59	136	·36	20	15
Borrowdale (Seathwaite)	*Cumberland*	10·96	1·57	—9·39	14	...	...	...
Cardiff (Ely)	*Glamorgan*	3·07	4·52	+1·45	147	1·13	21	15
Haverfordwest	*Pembroke*	3·42	3·97	+ ·55	116	·77	21	17
Aberystwyth (Gogerddan)	*Cardigan*	3·09	2·62	— ·47	85	·52	19	8
Llandudno	*Carnarvon*	2·11	1·19	— ·92	56	·28	22	12
Cargen [Dumfries]	*Kirkcudbrt.*	3·42	1·28	—2·14	37	·41	15	8
Marchmont House	*Berwick*	2·15	3·04	+ ·89	141	·67	20	17
Girvan (Pinmore)	*Ayr*	3·87	1·06	—2·81	27	·75	23	5
Glasgow (Queen's Park)	*Renfrew*	2·70	·60	—2·10	22	·30	15	4
Islay (Eallabus)	*Argyll*	3·91	1·22	—2·69	31	·27	6	11
Mull (Quinish)	,,	4·45	1·08	—3·37	24	·36	22	11
Loch Dhu	*Perth*	6·69	1·60	—5·09	24	·40	15	9
Dundee (Eastern Necropolis)	*Forfar*	1·91	1·86	— ·05	97	·35	22	15
Braemar	*Aberdeen*	2·55	1·09	—1·46	43	·41	20	7
Aberdeen (Cranford)	,,	2·36	1·97	— ·39	83	·50	20	16
Gordon Castle	*Moray*	1·95	1·55	— ·40	80	...	...	...
Drumnadrochit	*Inverness*	2·89	1·07	—1·82	37	·38	22	11
Fort William	,,	6·85	·64	—6·21	9	·19	18	·9
Loch Torridon (Bendamph)	*Ross*	7·53	1·40	—6·13	19	·39	22	·8
Dunrobin Castle	*Sutherland*	2·58	1·92	— ·66	74	·46	15	7
Glanmire (Lota Lodge)	*Cork*	3·76	3·93	+ ·17	105	·75	18	14
Killarney (District Asylum)	*Kerry*	4·99	2·36	—2·63	47	·55	22	15
Waterford (Brook Lodge)	*Waterford*	3·18	4.01	+ ·83	126	·86	4	16
Nenagh (Castle Lough)	*Tipperary*	2·89	2·03	— ·86	70	·51	21	11
Ennistymon House	*Clare*	3·44	2.56	— ·88	74	·41	6	13
Gorey (Courtown House)	*Wexford*	2·75	3·53	+ ·78	128	·45	4	16
Abbey Leix (Blandsfort)	*Queen's Co.*	2·55	1·96	— ·59	77	·54	21	15
Dublin (Fitz William Square)	*Dublin*	1·93	1·40	— ·53	73	·26	5	16
Mullingar (Belvedere)	*Westmeath*	2·67	1·87	— ·80	70	·38	21	12
Crossmolina (Enniscoe)	*Mayo*	4·20	2·14	—2·06	51	·38	5	16
Cong (The Glebe)	,,	3·72						
Collooney (Markree Obsy.)	*Sligo*	3·20	1·23	—1·97	38	·30	6	12
Seaforde	*Down*	2·81	1·99	— ·82	71	·56	15	12
Ballymena (Harryville)	*Antrim*	2·99	·66	—2·33	22	·17	19	9
Omagh (Edenfel)	*Tyrone*	2·68	·86	—1·82	32	.40	7	5

SUPPLEMENTARY RAINFALL, FEBRUARY, 1919.

Div.	STATION.	Rain inches.
II.	Warlingham, Redvers Road..	3·21
,,	Ramsgate	1·93
,,	Hailsham	2·92
,,	Totland Bay, Aston House...	2·83
,,	Stockbridge, Ashley..	2·61
,,	Grayshott	3·27
,,	Upton Nervet	2·71
III.	Harrow Weald, Hill House...	2·84
,,	Pitsford, Sedgebrook	3·30
,,	Woburn, Milton Bryant	2·96
,,	Chatteris, The Priory	2·73
IV.	Elsenham, Gaunts End	2·92
,,	Shoeburyness	2·25
,,	Colchester, Hill Ho., Lexden	2·98
,,	Aylsham, Rippon Hall	2·75
,,	Swaffham	2·57
V.	Bishops Cannings	2·29
,,	Weymouth	3·67
,,	Ashburton, Druid House	9·03
,,	Cullompton	3·58
,,	Lynmouth, Rock House	3·31
,,	Okehampton, Oaklands	3·65
,,	Hartland Abbey	3·83
,,	St. Austell, Trevarna	7·51
,,	North Cadbury Rectory	2·49
VI.	Clifton, Stoke Bishop	3·27
,,	Ledbury, Underdown	3·22
,,	Shifnal, Hatton Grange	2·48
,,	Droitwich	2·19
,,	Blockley, Upton Wold	3·42
VII.	Grantham, Saltersford	2·81
,,	Louth Westgate	2·90
,,	Bawtry, Hesley Hall	2·27
,,	Derby, Midland Railway	2·30
VIII.	Nantwich, Dorfold Hall	1·73
,,	Bolton, Queen's Park	1·15
,,	Lancaster, Strathspey	1·68
IX.	Langsett Moor, Up. Midhope	2·26
,,	West Witton	2·17
,,	Scarborough, Scalby	1·69
,,	Ingleby Greenhow	1·45
,,	Mickleton	1·80
X.	Bellingham, High Green Manor	2·02
,,	Ilderton, Lilburn Cottage	1·98
,,	Keswick, The Bank	·70
,,	Orton	1·36
XI.	Llanfrechfa Grange	5·96
,,	Treherbert, Tyn-y-waun	7·21
,,	Carmarthen, The Friary	3·90
,,	Fishguard, Goodwick Station.	2·29
,,	Crickhowell, Tal-y-maes	4·00
,,	Birmingham WW., Tyrmynydd	3·98
,,	Lake Vyrnwy	3·17
,,	Llangynhafal, Plas Drâw	2·93
,,	Rhiwbryfdir	3·25
,,	Dolgelly, Bryntirion	2·81
XI.	Lligwy	1·28
,,	Douglas, Isle of Man	1·57
XII.	Stoneykirk, Ardwell House	·93
,,	Carsphairn, Shiel	1·08
,,	Langholm, Drove Road	·99
XIII.	Selkirk, The Hangingshaw	1·55
,,	North Berwick Reservoir	1·92
,,	Edinburgh, Royal Observaty.	1·75
XIV.	Biggar	·58
,,	Maybole, Knockdon Farm	·12
XV.	Shiskine	1·36
,,	Ardgour House	1·06
,,	Oban	1·17
,,	Holy Loch, Ardnadam	1·18
,,	Loch Venachar	·70
XVI.	Glenquey	1·30
,,	Loch Rannoch, Dall	·53
,,	Blair Atholl	·97
,,	Coupar Angus	1·21
,,	Montrose, Sunnyside Asylum.	2·15
XVII.	Balmoral	1·45
,,	Fyvie Castle	1·91
,,	Keith Station	1·78
XVIII.	Rothiemurchus	·66
,,	Loch Quoich, Loan	·95
,,	Skye, Dunvegan	2·02
,,	Fortrose	1·31
,,	Glencarron Lodge	1·09
XIX.	Tongue Manse	1·94
,,	Melvich	1·41
,,	Loch More, Achfary	2·00
XX.	Dunmanway, The Rectory	5·76
,,	Mitchelstown Castle	2·80
,,	Gearahameen	4·80
,,	Darrynane Abbey	4·64
,,	Clonmel, Bruce Villa	2·22
,,	Roscrea Timoney Park	2·13
,,	Broadford, Hurdlestown	1·75
XXI.	Enniscorthy, Ballyhyland	4·01
,,	Rathnew, Clonmannon	3·26
,,	Hacketstown Rectory	2·45
,,	Ballycumber, Moorock Lodge	1·53
,,	Balbriggan, Ardgillan	1·65
,,	Castle Forbes Gardens	1·57
XXII.	Ballynahinch Castle	3·02
,,	Woodlawn	1·60
,,	Westport House	1·70
,,	Dugort, Slievemore Hotel	2·46
XXIII.	Enniskillen, Portora	·97
,,	Dartrey [Cootehill]	1·18
,,	Warrenpoint, Manor House	1·59
,,	Belfast, Cave Hill Road	1·65
,,	Glenarm Castle	3·24
,,	Londonderry, Creggan Res.	1·06
,,	Milford Manse	1·15
,,	Killybegs	1·50

Climatological Table for the British Empire, September, 1918.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	72·3	6	37·2	29	64·8	49·5	...	82	86·0	34·0	5·68	24	6·0
Malta	95·0	8	61·0	29	85·1	72·5	...	77	140·0	60·5	·80	2	0·4
Lagos	87·3	16	70·0	19	84·7	74·0	72·8	80	158·3	66·0	3·71	16	7·1
Cape Town	82·9	2	38·5	23	67·5	51·5	52·1	77	...	...	1·86	13	5·7
Johannesburg	78·9	11	37·0	7	71·4	51·1	42·8	61	...	34·0	·95	4	3·5
Mauritius	78·0	26*a*	55·0	10	76·0	61·0	58·0	70	...	49·0	·90	16	5·6
Bloemfontein	84·1	22*b*	34·8	6	72·6	46·3	43·9	61	...	...	2·25	7	5·6
Calcutta...	94·4	19	74·9	27	90·1	78·6	77·8	84	...	73·4	9·31	14	7·9
Madras	101·1	7	72·8	23	94·5	78·1	74·7	77	166·9	71·9	3·25	8	6·2
Colombo, Ceylon ...	88·1	17	72·8	18	86·8	76·7	71·7	76	164·8	68·5	1·06	11	7·6
Hongkong	89·8	11	73·4	30	83·5	76·5	73·2	81	...	...	18·45	17	6·4
Melbourne	81·3	26	34·2	7	64·9	45·7	43·1	61	133·1	22·8	3·44	14	4·3
Adelaide	86·8	26	38·2	22	68·4	47·2	45·4	60	145·1	28·3	·66	7	...
Coolgardie	93·0	30	37·5	4	75·9	48·7	42·4	44	155·5	33·5	·11	2	4·0
Brisbane	82·1	28	45·9	2	74·5	53·5	52·2	65	141·4	39·1	1·98	5	3·1
Hobart, Tasmania ..	77·9	26	35·1	7	59·6	44·2	39·2	58	132·9	26·3	2·60	16	5·4
Wellington ...	62·8	27	36·2	11	56·4	46·0	44·3	78	131·0	24·5	3·51	14	7·2
Jamaica, Kingston ..	91·9	7	71·2	27	90·0	73·9	72·3	78	...	...	·30	3	4·3
Grenada	90·0	4	72·0	13*c*	86·0	76·0	...	76	138·0	...	9·80	15	3·5
Toronto	80·6	3	39·0	22	65·6	47·3	47 9	84	131·2	34·0	4·64	18	5·8
Fredericton	77·0	3	30·8	12	65·5	45·1	49·1	80	...	...	8·02	15	5·4
St. John, N.B. ...	74·5	6	36·5	11	62·0	49·2	50·1	83	133·3	31·3	7·00	13	6·1
Victoria, B.C.	82·8	28	44·2	24	68·6	51·2	49·0	72	136·0	38·0	·10	2	2·4

a—27, 29. *b*—23. *c*—19.

Johannesburg.—Bright sunshine 267·2 hours.

COLOMBO, CEYLON.—Mean temp. 81°·7, or 0°·7 above, dew point 1°·7 below, and R 3·48 in. below, averages. Mean hourly velocity of wind 5·6 miles.

HONGKONG.—Mean temp. 79°·6. Bright sunshine 171·3 hours. Mean hourly velocity of wind 11·5 miles.

Melbourne.—Mean temp. 1°·3 above, and R 1·02 in. above, averages.

Adelaide.—Mean temp. 0°·8 above, and R ·66 in. below, averages. The lowest September fall with two exceptions in past 79 years.

Coolgardie.—Temp. 3°·6 above, and R from ·25 to ·50 in. below, averages.

Brisbane.—Temp. and R slightly below averages.

Hobart.—Temp. and R above averages.

Wellington.—Mean temp. 0°·3 below, and R ·63 in. below, averages. Bright sunshine, 148·5 hours. TS and H on the 18th.

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REPORT OF WATER POWER COMMITTEE.

The Board of Trade Committee on the Water Power Resources of the United Kingdom, of which Sir John Snell is Chairman, has issued an Interim Report to the President of the Board of Trade which has been published by the Stationery Office as Cmd. 79 of 1919, at the price of 2d. The Report deals not with the total resources of the country but with certain specific schemes for developing water-power in the Scottish Highlands. These are representative of many others and were selected as typical instances in which large powers could be economically developed. The value of the schemes depends partly on the possibility of transmitting electrical energy to industrial centres at a distance from the generating station and partly on the possibility of establishing new industries on the sea-board close to the source of power. In both cases the controlling factor is the cost of the necessary works and this is based on the reports of eminent engineers accustomed to the planning of large works, such as the Foyers and Kinlochleven establishments of the British Aluminium Company and the North Wales works of the British Aluminium Corporation. All the estimates are based on pre-war contract prices, plus fifty per cent. The Committee states that a Water Power scheme producing 5,000 electrical horse-power continuously and fully utilised will compare favourably with the best coal-fired electric generators of equal power with coal at 10s. per ton, if the capital cost of the undertaking does not exceed £60 per e.h.p.

Nine schemes are indicated in the Report on which work could be commenced as soon as the necessary Parliamentary powers are obtained. These range from 7,200 e.h.p., at Loch Morar, to 42,000 e.h.p. for a combined system of Lochs Ericht, Laidon, Rannoch and Tummel, and the estimated capital cost varies from £17 per e.h.p. for a 9,500 e.h.p. station, at Kilmorack Falls, to nearly £46 per e.h.p. for a 38,000 e.h.p. scheme at Lochs Laggan and Treig. The total electrical horse power of the nine schemes set out is estimated at 183,500, the total estimated cost at £7,075,000, which works out at £38·5 per e.h.p. on the average. The nine schemes would produce power equal to that yielded by 1,850,000 tons of

coal per annum, a figure which shows how absurd was the estimate of the Royal Commission on Coal Supplies in 1906 that all the available water power of the British Isles would be equivalent only to 1,200,000 tons of coal per annum. We are not aware that the Royal Commission referred to took any steps to obtain an authoritative estimate of the water power of the country, and their bad shot suggests that they did not. On the other hand we must bear in mind that the dreams of unlimited power to be obtained from water, which are frequently expounded in the newspapers, are even wider of the mark. The true value of the water power of any country can only be determined by careful and long continued surveys.

We cannot enter here into all the interesting features of this Report, but we must express our appreciation of the wise action of the Government in initiating a thorough enquiry into the subject, the results of which will doubtless be more fully developed in subsequent Reports. We may, however, quote from the concluding paragraphs which are of a general nature and point the way to future developments :—

> "There is no question that a river system and its drainage area must be taken as a unit and dealt with as a whole in regard to all the water problems incidental thereto. In this connection the Committee desires to draw attention to the recommendations of Lord Elgin's Commission on Salmon Fisheries, 1902, which advocated, *inter alia*, the setting up of Watershed Boards under a Supreme Rivers Authority. . . .
>
> The Committee wishes to draw attention to the fact that the estimates of water power dealt with in this Report have only been made possible by the voluntary work of Rainfall Observers in all parts of the British Isles, which has been collected and discussed by the British Rainfall Organization during the past 58 years. If the fullest use is to be made of the water-power resources of this country, it is essential that the work of observation should not only continue, but should be encouraged and developed.
>
> Another branch of observation which has a vital bearing upon the question of water-power resources is the gauging of the flow of rivers. Great attention has been given to this subject in Canada and the United States, but only a small amount of observation has hitherto been carried out in this country.
>
> Strong evidence has been submitted to the Committee regarding the lack of adequate training facilities in the Universities and Technical Institutes of the United Kingdom for young engineers wishing to enter the field of hydro-electric development. In view of the very large extension of water power development that is practically certain to take place in the near future, both in this country, in the British Empire, and in other countries, the Committee consider it important in the interests of British industry, that steps should be taken to remedy this state of affairs. . . ."

ROYAL METEOROLOGICAL SOCIETY.

THE usual annual lecture of this Society was delivered on Wednesday the 19th March, at the rooms of the Geological Society, Burlington House, by Professor Leonard Hill, F.R.S., the subject being "Atmospheric Conditions which affect Health." The President of the Society, Sir Napier Shaw, F.R.S., was in the Chair.

The lecturer first considered how far published meteorological data explained the influence of weather and climate on health and comfort, and in what way these data might be amplified to gain a better insight into this important matter. Numerous Observers make records of barometric pressure, temperature, rainfall, wind, etc., but the question arises as to whether there are not other data of greater importance and interest, which affect personal health and comfort and which might be recorded by them. Barometric pressure is measured with much refinement of accuracy, but we have no sensibility of the pressure of the atmosphere, which acts equally upon all parts of the body. In the past much has been made of the chemical alteration of the air in crowded places, and a false doctrine has become established and made popular. Careful analysis has shown that neither is there such a deficiency of oxygen or an excess of carbonic acid or other poisonous gas in the air of crowded rooms as to affect the health of human beings. Our feelings are largely due to swelling of the membrane of the nose and of its air sinuses. The victims of the Black Hole of Calcutta died from heat stroke, not from a poisonous vitiation of the air by the exhalations of the crowd. It is the cooling and evaporative power of the atmosphere, and the radiant heat of the sun, or other source of radiant energy, which have a colossal effect on our comfort and well-being, and it is these factors which require to be measured by the student of hygiene. The dry-bulb temperature does not suffice to indicate the cooling effect, because it is a static instrument averaging the influence of the environment, while the body is a dynamic instrument keeping itself at a nearly constant body temperature by the internal combustion of food and by heat loss from the skin and respiratory membrane, the heat gain and loss both being physiologically controlled. It is cooling power acting on the body surface, not temperature, which we require to study, and as the surface of the respiratory membrane is always wet and the skin may be made relatively dry or very wet by physiological control evaporative cooling is of no less importance than cooling by convection and radiation. To estimate cooling power Prof. Hill has introduced the kata-thermometer. This is a large bulbed spirit thermometer graduated between 100 and 95°F., giving a mean temperature of 36·5°C. which is arbitrarily taken as the surface temperature of the body. The instrument is heated in water at about 80°C., until the meniscus enters the small bulb at the top

of the stem ; the rate of cooling from 100° to 95°F. is then measured in seconds. Three to five such measurements are made and the average taken gives the dry kata reading. The bulb is then covered with a wetted muslin glove, and the operation repeated. The average gives the wet kata reading. Many thousands of kata observations have been taken in this country, also many in India, Egypt, Salonica front, Mesopotamia ; also some in New York, Nigeria and Melbourne. These admit of a contrast between indoor and outdoor conditions, and the conclusion is reached by Prof. Hill that the ordinary indoor conditions of this country approximate to outdoor conditions in such a humid tropical climate as Ceylon, admittedly an enervating climate to Europeans.

The following Candidates were balloted for and elected Fellows of the Society :—Lieut. H. C. Abraham, Lieut. R. P. Batty, F. G. Beaumont, Lieut. D. F. Bowering, Lieut. A. Mervyn Davies, W. E. Frankenburg, R. E. Horton, A. A. Kidson, Samuel Kniveton, Miss L. F. Lewis, A. H. Lupton, Sergt. F. L. Nunn, Sapper E. N. Redsell, C. F. Reed, T. A. Small, Lieut. A. Stocks.

METEOROLOGICAL OBSERVATIONS AT LU-KIA-PANG, CHINA, FOR 1918.

By Rev. J. de Moidrey S.J.

We have again been favoured by the kindness of Rev. J. de Moidrey, S.J., with summaries of the meteorological observations for 1918 at Lu-Kia-Pang, China, drawn up on similar lines to those for previous years, the first of which, for the year 1914, appeared in this Magazine for April, 1916. The records up to 1913 inclusive were published in the *Meteorologische Zeitschrift*.

I.—*Barometric Pressure. Millibars.*

	8 a.m.	2 p.m.	8 p.m.	Daily Mean.
Jan.	1030·42	1028·29	1029·79	1029·57
Feb.	26·19	24·19	25·41	25·31
Mar.....	21·86	20·15	21·06	21·02
April	15·43	14·05	14·78	14·70
May	11·47	09·94	10·12	10·43
June	06·96	05·82	06·24	06·26
July	*02·78*	*01·76*	*02·31*	*02·19*
Aug.	08·20	06·99	07·55	07·47
Sept.	12·24	10·58	11·70	11·40
Oct.	20·35	18·51	19·69	19·44
Nov.	24·24	22·41	23·82	23·44
Dec.	26·13	23·95	25·20	25·08
Year	1017·19	1015·55	1016·47	1016·36

IV.—*Mean amount of Cloud.*

Jan.	2·2
Feb.	6·7
Mar.	7·1
April	7·6
May	7·4
June	8·7
July	6·9
Aug.	5·6
Sept.	5·8
Oct.	4·9
Nov.	6·8
Dec.	8·0
Year	6·5

V.—*Days with Thunderstorms.*

Jan	—
Feb.	—
Mar.	—
April	2*a*
May	2
June	2
July	3
Aug.	8
Sept.	—
Oct.	—
Nov.	2*b*
Dec.	—
Year	19

a First, April 20 *b* Last, November 5.

II.—*Temperature.* *Degrees Centigrade.*

	MEAN DAILY.			MINIMUM.			
	Mean.	Lowest.	Highest.	Mean.	Hour. A.M. hr. min.	Lowest.	Highest.
	°	°	°	°		°	
Jan.	*+0·27*	*—3·2*	+3·5	*—4·6*	4 55	*—8·2*	+0·5
Feb.	5·43	+1·2	15·7	+1·5	5 25	—4·0	11·9
Mar.	7·82	1·9	15·6	4·1	4 40	—2·9	11·0
April	13·44	7·7	20·3	9·8	4 10	+1·7	15·6
May	18·73	12·4	23·4	14·2	4 0	7·8	19·9
June	23·08	18·3	29·3	19·7	3 40	14·0	25·0
July	26·97	22·6	29·2	23·7	3 55	20·8	**25·8**
Aug.	**27·24**	23·8	**29·8**	**23·8**	4 5	21·3	25·3
Sept.	22·87	17·2	27·8	19·1	4 45	12·3	25·2
Oct.	17·42	14·2	21·2	13·1	4 40	8·6	19·5
Nov.	11·07	4·9	18·9	8·0	4 55	0·5	17·4
Dec.	6·84	—0·6	11·9	4·9	4 35	—4·6	10·4
Year	15·10	—3·2*a*	29·8*b*	11·4	4 30	—8·2*c*	25·8*d*

Latest frost, March 2nd (—2°·9); earliest, December 10th (—0°·3).

II.—(*con.*)

	MAXIMUM				RANGE.		
	Mean.	Hour. P.M. hr. min	Lowest.	Highest.	Mean.	Lowest.	Highest.
	°		°		°	°	°
Jan.	*+6·9*	14 10	*+1·2*	+13·4	**11·5**	4·3	16·8
Feb.	10·9	13 55	3·7	26·1	9·4	2·5	**19·4**
Mar.	12·6	13 50	5·3	25·5	8·5	2·6	19·2
April	18·1	13 35	10·6	29·1	8·3	*1·3*	17·5
May	24·4	13 40	15·5	31·0	10·2	3·7	14·9
June	27·3	13 35	20·9	34·7	7·6	2·3	14·6
July	31·3	14 5	24·8	**35·6**	7·6	2·1	10·8
Aug.	**32·0**	13 40	26·0	35·4	8·2	3·5	11·2
Sept.	28·4	13 25	22·0	33·5	9·2	5·0	13·1
Oct.	23·7	13 5	18·2	27·1	10·6	2·8	15·5
Nov.	15·3	13 15	10·4	23·1	7·3	1·8	15·4
Dec.	9·6	13 10	2·8	15·1	*4·6*	*1·3*	11·2
Year	20·0	13 35	1·2*e*	35·6*f*	8·6	1·3*g*	19·4*h*

a Jan. 8. *b* Aug. 16. *c* Jan. 3. *d* July 8. *e* Jan. 7. *f* July 27. *g* April 6, Dec. 22. *h* Feb. 25

III.—*Relative Humidity.* *Per Cent.*

	RELATIVE HUMIDITY.			VAPOUR TENSION.		
	Mean.	Lowest.	Highest.	Mean.	Lowest.	Highest.
Jan.	*60*	*42*	82	*2·7*	*1·7*	4·6
Feb.	73	44	94	4·9	2·9	8·4
Mar.	79	54	97	6·6	4·0	9·5
April	80	55	95	9·7	6·2	14·9
May	71	48	95	12·2	8·0	17·2
June	81	62	**98**	17·9	12·1	24·8
July	**83**	68	97	22·6	19·1	**26·1**
Aug.	81	68	94	**22·8**	17·6	24·5
Sept.	77	57	94	16·8	8·3	23·8
Oct.	76	60	89	11·9	8·6	16·8
Nov.	80	61	97	8·4	4·7	15·4
Dec.	**83**	69	**98**	6·4	3·2	9·5
Year	77	42	98	11·9	1·7	26·1

(*To be continued*).

Correspondence.

To the Editor of Symons's Meteorological Magazine

RAINFALL AT HAVANA AND IN SOUTH-WEST ENGLAND.

For several years past attention has been drawn to the connection between the rainfall at Havana during the wet season, May to October, and that subsequently experienced in the south-west of England during the three months, January to March. This connection is shown by the correlation coefficient of —0·54, and implies that a heavy seasonal rainfall at Havana should be followed by a light rainfall during January to March in England S.W., and *vice versa*.

During May to October, 1918, the rainfall at Havana was only 42 per cent. of the fifty years' average, being the smallest amount for the season since the record started in 1859. In the south-west England for the three months now just closing the rainfall has been phenomenally heavy, the total being 155 per cent. of the average, and the wettest three first months of the year since at least 1878. Nine weeks out of the thirteen have been wetter than the average, one or two showing very large totals.

The following table gives the seasonal figures for the two districts during the past few years.

	Havana, May-October.	England, S.W., Jan.-March following.		Havana, May-October.	England, S.W. Jan.-March following.
1905 ..	49	148	1912 ..	108	139
1906 ..	143	66	1913 ..	87	138
1907 ..	60	84	1914 ..	71	129
1908 ..	116	82	1915 ..	82	126
1909 ..	101	116	1916 ..	74	67
1910....	108	81	1917 ..	57	94
1911 ..	66	146	1918 ..	42	155

A. HAMPTON BROWN.

70, Victoria Street, S.W. 1,- March 31st, 1919.

SNOW FOLLOWING FINE WEATHER.

The following considerations seem to show that the sequence of weather to which Dr. C. P. Hooker calls attention in your last issue, where an exceptionally fine day in early spring is followed by snow within a short period, is capable of a reasonable explanation. It not infrequently happens that a short period of brilliantly fine

weather is found in the rear of an anticyclone which is being pushed away eastward by a depression advancing towards this country from the Atlantic. If the advancing depression takes a southerly track and moves up the English Channel the cold north or north-east winds in its rear may very probably be accompanied by snowfall in the south of England, and thus snow following shortly after a brilliantly fine day is seen to be not improbable. On the other hand there must surely be many such fine days which are unassociated with a subsequent snowfall. If Dr. Hooker could supply the dates in previous years on which he has noticed this phenomenon it would be easy to test the above hypothesis. A study of the synoptic charts for the date in early March quoted in his letter shows that that occasion was of this type although it did not form a very good example and I doubt whether the fineness of March 2nd extended over a very wide area. At Benson, in South Oxfordshire, it was, as far as I remember, not an exceptionally fine day.

66, Sydney Street, S.W. 3, March 27th, 1919. J. S. DINES.

THE SLING OR WHIRLED PSYCHROMETER.

In the number of years in which I have been an interested reader of your Magazine I am unable to recall any reference or discussion as to the respective merits of wet and dry bulb thermometers and the sling, or whirled psychrometer. For some years I have been obtaining the relative humidity and dew point from the former, and not very long ago made a series of comparisons of the readings of both instruments. The wet and dry bulb thermometers were exposed in a standard instrument shelter, and sling psychrometer was whirled in the immediate vicinity facing the wind. I found such a wide difference in the readings that I have discarded the older instrument and now use the sling. In fact I do not consider the records observed on the old type as scientifically accurate.

The United States Weather Bureau began the use of the sling psychrometer in 1886. In connection with this instrument they say :—

> "The most reliable instrument for this purpose (to observe the difference between the temperatures indicated by wet and dry bulb thermometers) is the sling, or whirled psychrometer. In special cases rotary fans, or other means, may be employed to move the air rapidly over the thermometer bulbs. In any case satisfactory results cannot be obtained from observations in relatively stagnant air. A strong ventilation is absolutely necessary to accuracy."

When temperatures are below the freezing point the ease and celerity with which observations can be taken with the sling is very satisfactory. CHAS. DECKER.

Narberth, Pa., U.S.A., February 14th, 1919.

WET FIRST QUARTER OF YEAR.

I find that only twice during eighty years have we had more than 12 inches of rain in the first quarter of any year, and my object in looking up the figures was to find out whether there were droughts in the following quarters.

I send you the result of my search and the eighty years average.

	First Quarter in.	Second Quarter in.
Average 1839-1918 ..	6·48	5·34
,, 1844 ..	12·17	2·09
,, 1866 ..	12·76	3·96
,, 1919 ..	12·92	—

West Gate, Chichester, April 1st, 1919. G. ASHLEY TYACKE.

The rainfall at Totland Bay during the first quarter of the year 1919 amounts to 12·48 in. Our average here for this period is 6·46 in. The only first quarters giving over 10 inches total during my residence of thirty-three years have been :—

	1897	*1900*	*1906*	*1912*	*1919*
January ..	2·45	3·60	6·80	4·12	4·81
February ..	3·41	5·07	3·13	2·62	2·83
March ..	4·30	1·47	1·44	3·41	4·84
Total ..	10·16	10·14	11·37	10·15	12·48

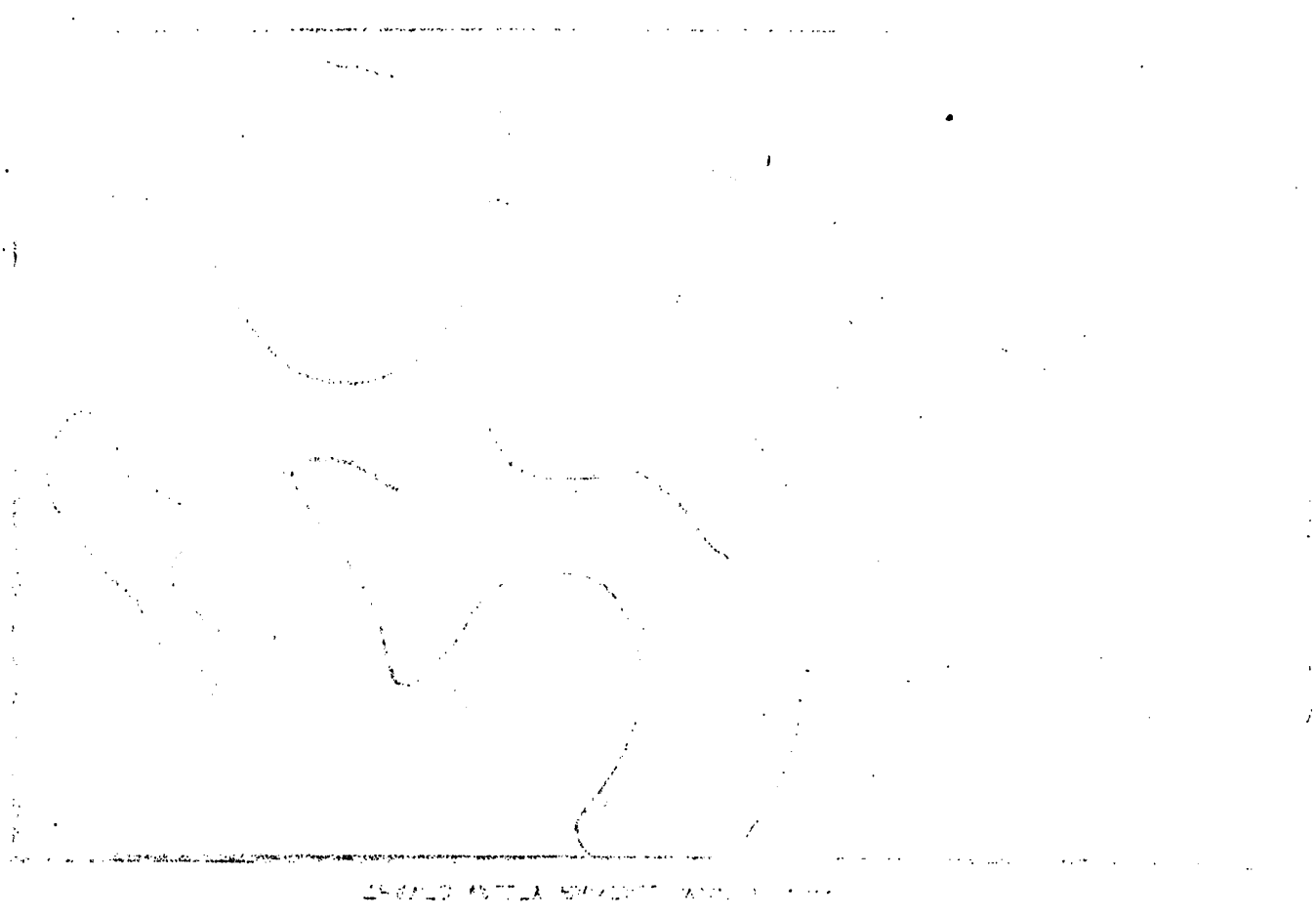
JOHN DOVER.

Aston House, Totland Bay, Isle of Wight, 1st April, 1919.

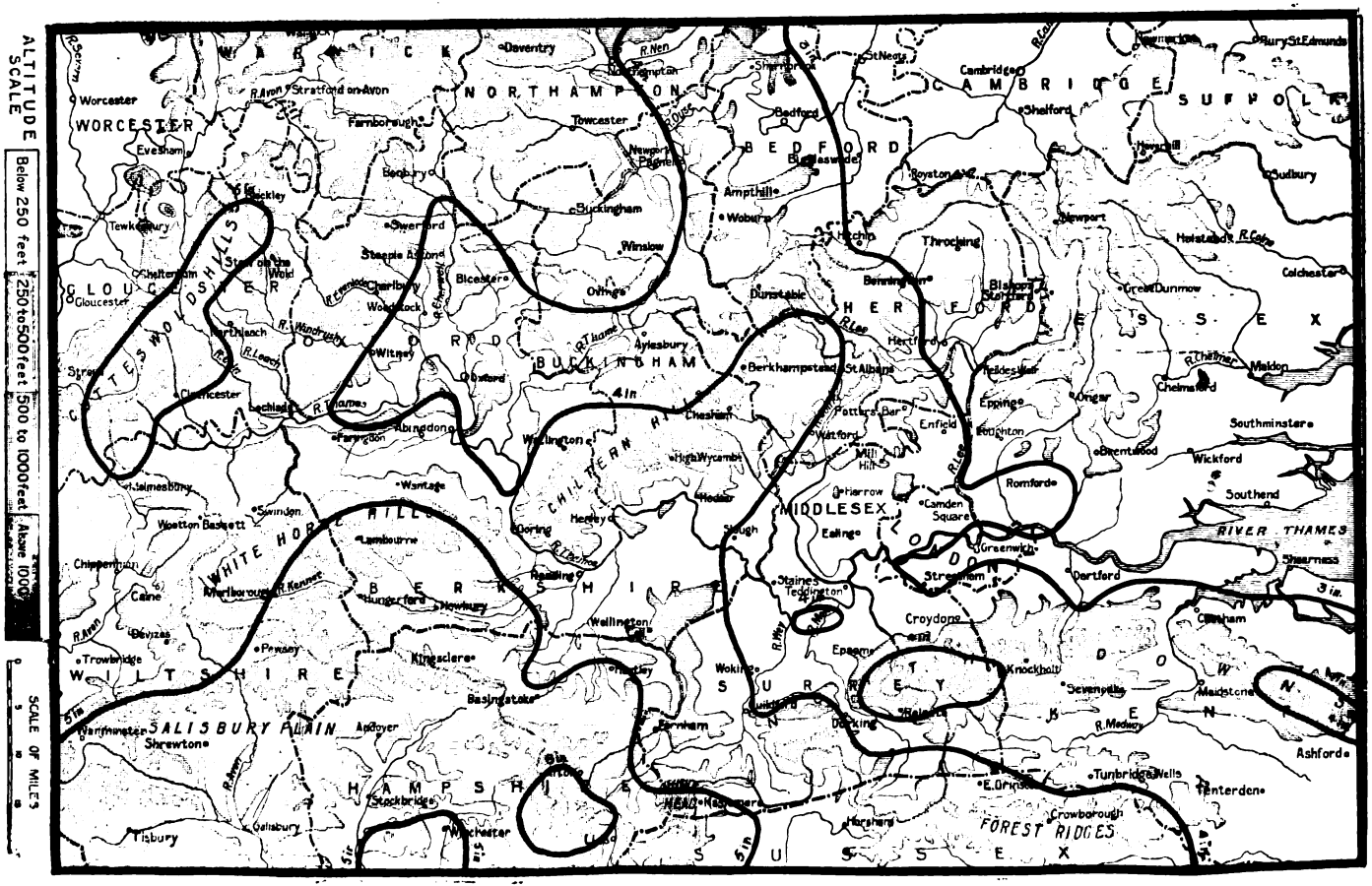
REMARKABLE UNIFORMITY OF TEMPERATURE.

The phenomenon mentioned by the Rev. T. E. R. Phillips of a fall of temperature by day and a rise by night during cold, cloudy, easterly weather in winter is one which I have often noticed; but I believe it is more pronounced in the south of England than elsewhere. The explanation, I believe, is that in this type of weather there is severe cold on the Continent, often with clear skies, and the low temperature of early morning is carried to our shores by the east wind in the course of the day, while the higher temperature of the sunny daytime on the Continent similarly arrives during the following night. Our skies are cloudy owing to the vapour gathered by the wind in crossing the North Sea, hence the warming influence of the sun by day is shut out from us. I have noticed this inversion of the usual temperature change here in Lincolnshire, but it used to be more pronounced in Hertfordshire. ALLAN ELLISON.

Althorpe Rectory, Lincolnshire. March 27th, 1919.



THAMES VALLEY RAINFALL MARCH. 1919.



Symons's Meteorological Magazine

THE WEATHER OF MARCH.

SOME of the most disagreeable weather we experience in these islands occurs when the country occupies a position between two areas of high barometric pressure. The intervening trough forms a prolific breeding ground for cyclonic depressions; and as the driving power (if one may so express it) of the nearest high pressure system is largely restrained by the driving power of its more distant compeer such disturbances usually move slowly, and the accompanying bad weather is consequently of a more or less lingering character.

These were the conditions prevailing during a considerable portion of last month. A large anticyclone maintained a fairly normal position over the south of the North Atlantic, but at frequent intervals there was a second high pressure system in existence, sometimes in the Icelandic region, at other times over northern Europe. In these circumstances the British Isles were exposed to numerous depressions, many of which travelled in a general easterly course over our southern districts, the Channel and the north of France. In the south the winds showed considerable variability in direction, but over the country as a whole they were more often than not from some polar quarter, and as a result the mean temperature of the month was considerably below the average.

During the earlier half the weather was changeable and wet, more especially in the western districts. Temperature was usually below the normal, but, during a brief period of south-westerly winds which prevailed at the beginning of the month, and a similar spell which occurred between the 9th and 11th, the thermometer rose slightly above 55° in many parts of England. Sharp frost was experienced, however, in Ireland and Scotland on the night of the 3rd, over England on the night of the 5th, and over the United Kingdom generally between the 13th and 15th.

After about the middle of the month the weather (contrary to rule) became colder even than in the earlier half, and between the 23rd and 26th, when an anticyclonic band extended temporarily from south-west to north-east across the United Kingdom, sharp frosts were experienced in all districts. In many parts of England the screened thermometer fell below 25°, and at some northern stations below 20°, a minimum of 11° being reported on the 25th at Balmoral. On the 26th and 27th the passage south-eastward of a deep storm system from Iceland to Scotland, and thence across the North Sea was accompanied by a general gale from the N.W.; and, on the night of the 28th-29th, when a secondary depression moved eastward along the Channel, a heavy fall of snow was experienced in the south of England. In London the flakes were of a remarkably fine texture, and although the ground was covered to the unusual depth of 7 to 10 inches, the snow, when melted, did not yield more than ·25 in. to ·30 in. of water in the gauge.

The total duration of bright sunshine for the month was below the average in all districts except the north and east of Scotland.

The total rainfall of the month exceeded twice the average over practically all England and Wales, except in the eastern and extreme northern counties. The amounts varied from about 2 inches in East Anglia to more than 5 inches over large areas in the south and Midlands, and rose to above 10 inches in the Welsh mountains and the Lake District. In Scotland the excess was not remarkable and in many areas the fall was short of the average. Less than 2 inches fell on the east coast and from 5 to 10 inches in the wettest parts of the Highlands. Ireland was wet generally, but a few scattered stations had less than the average. Less than 2 inches fell over the centre, and 5 inches was exceeded only in the extreme west.

The general rainfall expressed as a percentage of the average was :—England and Wales, 196; Scotland, 105; Ireland, 112; British Isles, 143.

In London (Camden Square) the mean temperature was 40°·5, or 1°·6 below the average. The duration of sunshine was 83·3 hours, and of rainfall 103·2, hours the latter being the highest value recorded in March in the past thirty-nine years, except in March, 1916, when it rained for 133·6 hours. Evaporation, ·66 inches.

RAINFALL TABLE FOR MARCH, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875–1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	1·70	3·62	+1·92	213	·88	19	21
Tenterden	*Kent*	1·95	3·51	+1·56	180	·70	5	20
Arundel (Patching)	*Sussex*	1·95	5·36	+3·41	275	1·14	19	19
Fordingbridge (Oaklands)	*Hampshire*	2·09	5·47	+3·38	261	1·11	19	19
Oxford (Magdalen College)	*Oxfordshire*	1·45	3·76	+2·31	259	1·01	19	22
Wellingborough (Swanspool)	*Northampn*	1·72	3·91	+2·19	228	·94	19	20
Bury St. Edmunds (Westley)	*Suffolk*	1·71	2·40	+ ·69	140	·32	7	17
Geldeston [Beccles]	*Norfolk*	1·57	1·78	+ ·21	113	·27	7	17
Polapit Tamar [Launceston]	*Devon*	2·74	5·37	+2·63	196	·68	10	23
Rousdon [Lyme Regis]	,,	2·30	4·95	+2·65	215	1·12	18	19
Stroud (Field Place)	*Gloucester*	2·01	4·37	+2·36	218	...	...	...
Church Stretton (Wolstaston)	*Shropshire*	2·19	5·29	+3·10	241	1·36	12	9
Boston	*Lincoln*	1·47	2·47	+1·00	168	·43	19	22
Worksop (Hodsock Priory)	*Nottingham*	1·70	3·59	+1·89	211	·85	11,19	15
Mickleover Manor	*Derbyshire*	1·69	5·23	+3.54	309	1 27	19	21
Congleton (Buglawton Vic.)	*Cheshire*	2·16	4·90	+2·74	227	·82	11	21
Southport (Hesketh Park)	*Lancashire*	2·11	5·31	+3·20	252	1·25	11	17
Wetherby (Ribston Hall)	*York, W.R.*	1·92	3·88	+1·96	202	1·23	19	11
Hull (Pearson Park)	,, *E.R.*	1·84	2·67	+ ·83	145	·55	11	17
Newcastle (Town Moor)	*North'land*	2·10	2·76	+ ·66	131	·53	9	18
Borrowdale (Seathwaite)	*Cumberland*	10·63	11·30	+ ·67	106	...	...	...
Cardiff (Ely)	*Glamorgan*	2·89	5·97	+3·08	207	·64	18	22
Haverfordwest	*Pembroke*	3·16	5·55	+2·39	176	1·20	18	20
Aberystwyth (Gogerddan)	*Cardigan*	3·04	8·57	+5·53	282	1·97	11	19
Llandudno	*Carnarvon*	2·13	5·75	+3·62	270	1·55	11	24
Cargen [Dumfries]	*Kirkcudbrt.*	3·33	4·83	+1·50	145	2·11	19	13
Marchmont House	*Berwick*	2·64	2·78	+ ·14	105	·44	19	18
Girvan (Pinmore)	*Ayr*	3·62	4·37	+ ·75	121	1·03	20	14
Glasgow (Queen's Park)	*Renfrew*	2·61	2·62	+ ·01	100	·65	19	10
Islay (Eallabus)	*Argyll*	3·68	5·23	+1·55	142	1·02	18	19
Mull (Quinish)	,,	4·28	4·24	— ·04	99	·76	18	21
Loch Dhu	*Perth*	6·29	5·95	— ·34	95	1·15	19, 26	13
Dundee (Eastern Necropolis)	*Forfar*	2·06	1·64	— ·42	80	·42	19	18
Braemar	*Aberdeen*	2·87	4·51	+1·64	157	1·00	27	16
Aberdeen (Cranford)	,,	2·65	2·16	— ·49	82	·47	27	20
Gordon Castle	*Moray*	2·36	2·09	— ·27	89	...	...	...
Drumnadrochit	*Inverness*	3·09	2·72	— ·37	88	·85	26	21
Fort William	,,	6·39	3·95	—2·44	62	1·22	26	19
Loch Torridon (Bendamph)	*Ross*	7·29	7·99	+ ·70	110	2·29	26	20
Dunrobin Castle	*Sutherland*	2·64	2·77	+ ·13	105	·55	26	10
Glanmire (Lota Lodge)	*Cork*	3·09	3·07	— ·02	99	·40	13	20
Killarney (District Asylum)	*Kerry*	4·51	3·71	— ·80	82	·52	28	27
Waterford (Brook Lodge)	*Waterford*	2·64	2.96	+ ·32	112	·36	3	23
Nenagh (Castle Lough)	*Tipperary*	2·99	3·29	+ ·30	110	·46	12	25
Ennistymon House	*Clare*	3·24	3.11	— ·13	96	·41	12	19
Gorey (Courtown House)	*Wexford*	2·28	2·48	+ ·20	109	·39	28	14
Abbey Leix (Blandsfort)	*Queen's Co.*	2·59	2·94	+ ·35	113	·62	4	22
Dublin (Fitz William Square)	*Dublin*	1·98	2·19	+ ·21	111	·38	18	21
Mullingar (Belvedere)	*Westmeath*	2·64	1·83	— ·81	69	·42	19	15
Crossmolina (Enniscoe)	*Mayo*	4·36	5·39	+1·03	124	·95	6	26
Cong (The Glebe)	,,	3·80	..	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	3·33	4·07	+ ·74	122	·66	17	20
Seaforde	*Down*	2·84	3·86	+1·02	136	1·45	18	17
Ballymena (Harryville)	*Antrim*	3·07	4·70	+1·63	153	1·22	17	22
Omagh (Edenfel)	*Tyrone*	2·98	·99	+1·01	134	.88	18	

SUPPLEMENTARY RAINFALL, MARCH, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Warlingham, Redvers Road..	4·86	XI.	Lligwy	5·18
,,	Ramsgate	2·70	,,	Douglas, Isle of Man	4·72
,,	Hailsham	4·39	XII.	Stoneykirk, Ardwell House...	3·49
,,	Totland Bay, Aston House...	4·84	,,	Carsphairn, Shiel	6·81
,,	Stockbridge, Ashley..	4·85	,,	Langholm, Drove Road	4·95
,,	Grayshott	5·44	XIII.	Selkirk, The Hangingshaw..	4·73
,,	Upton Nervet	5·35	,,	North Berwick Reservoir	1·47
III.	Harrow Weald, Hill House...	3·48	,,	Edinburgh, Royal Observaty.	1·34
,,	Pitsford, Sedgebrook	4·11	XIV.	Biggar	2·24
,,	Woburn, Milton Bryant	...	,,	Maybole, Knockdon Farm ...	2·45
,,	Chatteris, The Priory	2·08	XV.	Shiskine	5·57
IV.	Elsenham, Gaunts End	2·63	,,	Ardgour House	4·81
,,	Shoeburyness	...	,,	Oban	3·16
,,	Colchester, Hill Ho., Lexden	2·21	,,	Holy Loch, Ardnadam	6·81
,,	Aylsham, Rippon Hall	2·04	,,	Loch Venachar	4·95
,,	Swaffham	2·26	XVI.	Glenquey	3·90
V.	Bishops Cannings	4·85	,,	Loch Rannoch, Dall	3·29
,,	Weymouth	4·68	,,	Blair Atholl	2·66
,,	Ashburton, Druid House	7·03	,,	Coupar Angus	1·90
,,	Cullompton	4·99	,,	Montrose, Sunnyside Asylum.	1·54
,,	Lynmouth, Rock House	6·01	XVII.	Balmoral	3·25
,,	Okehampton, Oaklands	6·44	,,	Fyvie Castle	3·13
,,	Hartland Abbey	3·88	,,	Keith Station	3·04
,,	St. Austell, Trevarna	5·90	XVIII.	Rothiemurchus	...
,,	North Cadbury Rectory	4·65	,,	Loch Quoich, Loan	10·40
VI.	Clifton, Stoke Bishop	5·70	,,	Skye, Dunvegan	6·23
,,	Ledbury, Underdown	4·61	,,	Fortrose	1·95
,,	Shifnal, Hatton Grange	4·78	,,	Glencarron Lodge	5·25
,,	Droitwich	3·97	XIX.	Tongue Manse	3·99
,,	Blockley, Upton Wold	5·42	,,	Melvich	3·46
VII.	Grantham, Saltersford	3·92	,,	Loch More, Achfary	7·27
,,	Louth, Westgate	3·22	XX.	Dunmanway, The Rectory ..	4·65
,,	Bawtry, Hesley Hall	3·15	,,	Mitchelstown Castle	2·92
,,	Derby, Midland Railway	4·41	,,	Gearahameen	7·50
VIII.	Nantwich, Dorfold Hall	5·28	,,	Darrynane Abbey	4·54
,,	Bolton, Queen's Park	7·31	,,	Clonmel, Bruce Villa	2·90
,,	Lancaster, Strathspey	4·41	,,	Roscrea, Timoney Park	2·48
IX.	Langsett Moor, Up. Midhope	5·67	,,	Broadford, Hurdlestown	2·96
,,	West Witton	4·87	XXI.	Enniscorthy, Ballyhyland...	3·30
,,	Scarborough, Scalby	4·94	,,	Rathnew, Clonmannon	2·21
,,	Ingleby Greenhow	4·33	,,	Hacketstown Rectory	...
,,	Mickleton	1·50	,,	Ballycumber, Moorock Lodge	1·61
X.	Bellingham, High Green Manor	2·87	,,	Balbriggan, Ardgillan	2·18
,,	Ilderton, Lilburn Cottage ...	2·47	,,	Castle Forbes Gardens	2·26
,,	Keswick, The Bank	5·03	XXII.	Ballynahinch Castle	3·93
,,	Orton	6·05	,,	Woodlawn	1·11
XI.	Llanfrechfa Grange	6·43	,,	Westport House	3·77
,,	Treherbert, Tyn-y-waun	10·90	,,	Dugort, Slievemore Hotel ...	6·07
,,	Carmarthen, The Friary	6·42	XXIII.	Enniskillen, Portora	2·67
,,	Fishguard, Goodwick Station.	4·12	,,	Dartrey [Cootehill]	2·76
,,	Crickhowell, Tal-y-maes	6·50	,,	Warrenpoint, Manor House ..	2·71
,,	Birmingham WW., Tyrmynydd	8·12	,,	Belfast, Cave Hill Road	4·29
,,	Lake Vyrnwy	7·43	,,	Glenarm Castle	3·37
,,	Llangynhafal, Plas Drâw	4·70	,,	Londonderry, Creggan Res...	4·68
,,	Rhiwbryfdir	11·99	,,	Milford Manse	4·06
,,	Dolgelly, Bryntirion	8·70	,,	Killybegs	6·54

Climatological Table for the British Empire, October, 1918.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp.	Minimum. Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	64·5	6	32·4	1	57·2	43·8	...	90	113·6	28·2	1·23	16	8·1
Malta	86·0	1	57·0	10	73·9	65·7	62·5	82	133·5	53·5	4·28	9	2·6
Lagos	90·0	24	69·4	8	86·1	74·1	73·4	77	162·4	66·0	4·11	14	7·2
Cape Town	83·9	27	40·9	4	69·9	54·1	53·4	73	...	...	1·73	10	5·8
Johannesburg	83·1	19	45·3	15	73·3	54·4	49·9	68	...	44·0	4·90	16	4·8
Mauritius	85·0	30	60·0	13	80·0	65·0	62·0	71	...	54·0	1·36	18	6·1
Bloemfontein	84·1	11	39·0	9	77·2	51·2	50·6	62	...	...	2·39	6	4·3
Calcutta...	93·9	4	69·7	23	89·6	74·3	72·0	74	...	62·2	·29	2	3·0
Madras	96·3	12	68·6	26	92·1	75·0	70·9	70	165·5	65·4	4·34	2	3·2
Colombo, Ceylon ...	87·8	29	71·8	6, 10	85·9	74·6	73·4	83	160·1	67·8	14·76	19	7·6
Hongkong	88·2	23	67·6	26	81·6	72·5	64·2	56	...	...	·05	1	4·2
Sydney	91·6	30	42·3	3	72·0	53·4	48·7	56	141·6	47·7	·77	10	4·2
Melbourne	79·2	19	32·2	3	65·0	47·4	44·6	63	134·0	24·8	2·35	...	6·9
Adelaide	87·8	29	37·9	5	70·2	51·2	47·6	60	144·0	27·8	2·59	11	5·5
Perth	88·0	14	43·2	3	68·6	52·8	50·9	70	150·2	35·0	2·90	15	5·0
Coolgardie	97·0	15	39·8	7	77·7	51·1	43·7	42	155·0	36·0	·16	1	3·5
Brisbane	100·1	28	53·4	3	83·7	60·9	56·4	56	157·4	49·0	1·14	7	3·8
Hobart, Tasmania ...	74·5	11	34·1	3	58·6	44·0	39·9	61	138·3	29·1	3·13	22	6·8
Wellington	69·6	9	38·2	12	60·3	49·4	46·7	75	141·0	26·8	6·48	17	6·6
Jamaica, Kingston ...	92·3	12	71·6	31	88·5	73·7	72·4	82	...	...	2·17	11	7·4
Grenada	...	...	...	...	...	...	...	...	...	...	...	.	...
Toronto	73·3	10	30·0	15	60·0	42·8	44·4	88	122·6	25·0	2·84	13	5·0
Fredericton	66·8	13	21·0	20	56·8	36·1	39·2	77	...	...	4·80	11	5·5
St. John, N.B. ...	64·2	10	31·7	19	53·3	40·8	41·2	80	120·3	26·0	6·56	14	6·2
Victoria, B.C.	66·5	1	40·3	14	56·4	46·2	47·0	89	121·5	34·8	4·13	16	6·7

Johannesburg.—Bright sunshine 237·7 hours.

COLOMBO, CEYLON.—Mean temp. 80°·2, or 0°·1 above, dew point 0°·3 below, and R 1·33 in. above, averages. Mean hourly velocity of wind 3·2 miles. TS on 9 days.

HONGKONG.—Mean temp. 76°·4. Bright sunshine 234·5 hours. Mean hourly velocity of wind 10·8 miles.

Melbourne.—Mean temp. 1°·4 below, and R ·26 in. below, averages.

Adelaide.—Mean temp. 1°·2 below, and R ·87 in. above, averages.

Coolgardie.—Temp. 0°·8 below, and R about ·50 in. below, averages.

Brisbane.—Temp. above, and R below, averages. Highest shade maximum for October since 1887 with one exception.

Hobart.—Temp. below, and R ·89 in. above, averages.

Wellington.—A wet month. Mean temp. 0°·6 above, and R 2·28 in. above, averages. Bright sunshine, 160·2 hours. Frost on 2 days. TS on 2 days.

Symons's
Meteorological Magazine.

No. 640. MAY, 1919. Vol. LIV.

WEATHER FORECASTS FOR AIR AND SEA.

The Times announces over the signature of Admiral J. F. Parry, Hydrographer of the Navy, that in view of the extent to which aircraft will have to rely for information as to weather conditions upon data from ships at sea, the Admiralty have issued a notice to mariners making arrangements for a new and comprehensive scheme. This involves the collection by wireless of meteorological data from ships in all parts of the world and at the same time the organisation of free transmission of weather bulletins from a sufficient number of wireless stations to admit of ships being constantly supplied with reliable weather reports and forecasts wherever they may be.

Six or eight observation stations are being established in the North-eastern Atlantic and ships are asked to supply to them information regularly at 1 a.m., 7 a.m. and 1 p.m. (G.M.T.) each day, besides sending additional messages when required to do so from areas in which peculiar conditions obtain. All ships fitted with the necessary apparatus will be called upon to assist, but on receipt of an intimation that another ship in the vicinity is reporting no message will be sent. This avoids not only duplication, but interference, a very necessary precaution with wireless telegrams. The technical difficulties of securing priority of transmission are considerable, but they can be overcome by co-operation. Should it prove impossible to decipher long-range telegrams, international "silent periods" might possibly have to be resorted to, but it is hoped that this may be avoided. Earnest endeavours are being made to secure international agreement in the matter of codes, signals, times and methods in general.

The organization which has been undertaken by the Meteorological Office involves the collection of observations by code messages, at Valencia and Malin Head. The data will then be transmitted to

London by wireless for co-ordination. Wireless bulletins will be issued, and may include either a weather report, that is an official statement of existing conditions in some particular area, or a weather forecast of the probable weather conditions, or both. A list is given of 42 wireless transmission stations in all parts of the world from which bulletins will be issued regularly. There are in addition certain other stations which will be available for the supply of information on demand. The British stations proposed are Poldhu, in Cornwall, and Cleethorpes, in Lincolnshire, both of which will shortly be ready for the purpose.

Quite apart from the enormous advance in the economic utilization of modern weather forecasting, the scheme holds almost boundless possibilities for the development of scientific meteorology, and we look forward with the highest hopes to the fruition of so important a scheme of co-operative effort.

ROYAL METEOROLOGICAL SOCIETY.

A MEETING of this Society was held on April 16th at 70, Victoria Street, S.W., Mr. F. J. W. Whipple, M.A., Vice-President, in the Chair.

Mr. A. A. Barnes, C.E., read a paper entitled, "Rainfall in England: the true long-average as deduced from symmetry." It had been usual to assume that the average annual rainfall during any period of 35 years can be adopted for obtaining the "long average" at any rain gauge, but the author considered that the fluctuations which occurred between such averages for various thirty-five year periods tended to show that the basis was somewhat uncertain. By an exhaustive analysis by mean of plotting the residual mass curves of the annual totals of thirty-eight rain gauges in England during 1856-1917, the author proved that variations of as much as 5 per cent. on each side of the mean were possible when dealing with successive thirty-five year periods. From the same records it was shown that far greater consistency in the value of the average can be obtained by taking periods symmetrical about the end of the year 1886. By means of tables and diagrams the author showed that that date was a critical one in regard to rainfall in England, and that as a rule the years before were relatively wetter than years subsequent to it. Hence the balancing of the earlier wet years by the later dry years established the principle of symmetry about that date. It was shown that by this method the maximum departure from normal resulting from taking each of the fifteen long periods symmetrical to the end of the year 1886 did not exceed 1 per cent. in the case of any of the thirty-eight gauges.

Mr. C. E. P. Brooks, M.Sc., read a paper entitled, "The Secular Variation of Rainfall." In order to obtain a measure of the secular variation of rainfall during the past 30 to 50 years, correlation coefficients were worked out between the annual rainfall at each station and "time," the measure of the latter being the number of years before or after the middle year of the series. This was done for 162 stations distributed over the globe, and the results were plotted on a map. The map showed that the greater part of the world was divided into a few definite regions of wide extent, in each of which the rainfall had been either increasing or decreasing. The most important area of increasing rainfall was temperate Eurasia (except the western sea-board); other areas were south-east South America and the south of Australia. Areas of decrease were the tropical regions as a whole, South Africa and the west coast of Europe. It was noted that the number of sunspots and also of solar prominences during the period in question had been decreasing. For a few stations records of longer period were dealt with, giving indications that the results obtained were due to a periodicity of upwards of 50 years.

A discussion followed in which Mr. F. J. W. Whipple thanked the authors for their valuable papers and hoped that Mr. Barnes would extend his investigation to include Scotland and Ireland. Mr. Carle Salter suggested that it would probably be found that the shorter phased rainfall fluctuations were local, the longer ones less so, and the longest possibly world-wide, as Mr. Brooks contended. Mr. R. H. Hooker and Mr. E. H. Chapman considered that the low correlation coefficients and the irregular nature of distribution in Mr. Brooks's results were highly inconclusive and well within the range of accidental error. Mr. H. E. Carter, who had examined some records outside the area considered by Mr. Barnes, said that the symmetry about the end of 1886 apparently held good in the Scottish Highlands, but did not exist at the two Irish stations considered. In a written communication, Dr. H. R. Mill called attention to a possible wave-length in the residual mass curves of about sixty years over the north of England and about forty years over the south, and suggested that it might be found that a symmetry existed about the minima of the curves similar to that which Mr. Barnes had proved to exist about the maxima. Mr. J. Baxendell wrote that the 1886 discontinuity found by Mr. Barnes probably arose from the synchronization of several periods of different length.

The following candidates were balloted for and elected Fellows of the Society :—T. J. Arnold, Surg.-Lt. R. A. D. J. Bernhardt, R.N.V.R., G. T. Osborn, L. F. Richardson, A.M.I.E.E., G. L. Smith, C. A. Spon, Lieut. D. N. Stewart, R.A.F., R. L. Waterfield, and C. J. Wyke.

Correspondence.

To the Editor of Symons's Meteorological Magazine

DEW PONDS.

In your note on Dew Pond construction in the February number, you describe Mr. G. Hubbard's experiment as being extremely interesting and successful. But, judging from the report in *The Times*, he only showed over again what has perhaps been known in India for centuries that a body placed in a pit and thermally isolated from the earth will fall to a lower temperature on a still clear night than surrounding bodies not isolated. He has neither shown that the surface of a "dew pond" will fall so low nor that dew will condense upon such a surface.

My immediate object in writing, however, is in reference to Mr. Hubbard's extraordinary statement that there are "natural dew ponds in the Colesberg district of Cape Colony, where in the absence of springs, streams, and rains, ponds have a higher water level in the morning than they had in the previous evening" (*Times* Report). Seeing that this statement is at variance with the common assertion (baseless, of course), that evaporation in South Africa goes on more rapidly by night than by day, and just to ascertain whether there was any sort of foundation in rumour or in imagination or otherwise, for what Mr. Hubbard is reported to have said, I wrote to the Resident Magistrate at Colesberg, quoting *The Times* Report and asking whether the claim had ever been made locally, to his knowledge, that the water in the ponds in his district increases during the night, and if so how the measurements were made. His reply is short and to the point :—

> "I have the honour to inform you that from information received it would appear that there is no basis of truth in the statement made by Mr. G. Hubbard."

The rain maker has had a long and a flourishing career. Is he going to be supplanted at last by the dew maker?

Kimberley, South Africa, March 30th, 1919. J. R. SUTTON.

RAINFALL OF JANUARY TO APRIL.

I have to report 14·07 in. of rain for the past four months, the wettest January to April since 1877, when 14·23 in. fell. This was also the first year since then with the rainfall of all four months above the average.

January and February were wetter in 1900 and 1915, February and March much wetter in 1914 and 1916, and March in 1909 and 1912. But April had over 3 inches before only in 1871, 1878, 1879 and 1907, the wettest being 3·81 in., in 1878. J. ELLIS MACE.

View Tower, Tenterden, May 1st, 1919.

MAMMATO-CUMULUS.

METEOROLOGICAL writers appear to be almost unanimous upon at least one point and that is the "rare occurrence and fleeting duration of the mammilated or festooned appearance of cloud usually designated by the prefix "Mammato."

My own experience as an amateur Observer of cloud phenomena convinces me that the occurrence is by no means so rare as they might lead us to suppose, and that the modification in question is not confined exclusively to cumuliform clouds is shown by the fact that I personally recorded during the years 1911-1913 inclusive 101 occasions upon which mammato effects were observed and that these were distributed over six different types of cloud.

The descriptions usually met with are not very lucid and some confusion on the subject evidently exists in the minds of meteorologists, unless it is that their powers of observation are at fault, for most authors who consider it worth their while to discuss cloud forms at any length (and they are few), maintain the idea of the rarity of the phenomenon, whilst Sir J. W. Moore, in his "Meteorology" testifies to having often seen it and W. M. Davis in "Elementary Meteorology" conveys the impression that there is nothing unusual in the occurrence.

The cloud effects recorded by me as "Mammato" are in agreement with those indicated in the photographic illustrations under that head in Capt. Cave's "The Forms of Clouds," in the "Meteorological Glossary," and in Dr. Lockyer's article in Cassell's "Nature Book," respectively.

I have already fourteen instances recorded during the first four months of this year, and the face of the sky here during the evening of Friday, 25th April, was among the most ominous and threatening I have ever seen. The Mammato effect could scarcely have failed to make a vivid impression upon the mind of the most casual observer.

It is not my intention to discuss here the general significance of this phenomenon, but it is not without interest to record that we experienced a respectable thunderstorm within twenty-four hours and a prolonged and destructive blizzard on the second day, neither of which appear to have been anticipated in the forecasts issued to the Press.

On this occasion at least the sequence of severe weather more than justified the conclusion of the late Rev. W. Clement Ley, viz., that "the cloud seems to be one indicating the very worst possible description of weather," and of that other great student of clouds, Mr. A. W. Clayden, who says, that "it is an indication of very disturbed conditions."

A. S. MARTIN-SMITH.

71, Wood Street, Barnet, April 28th, 1919.

SNOWFALL OF APRIL 28th.

RAIN here began about 9.30 a.m. (G.M.T.), gradually giving a steady downpour of rain and sleet. Before 4 p.m. it almost ceased. About 4.10 an ashen mist supervened, with fine snow, from north-west. The rain began with wind from north-west, but it backed slowly to south-east by about 1 p.m. and remained there until 4 p.m. By 4.30 it was snowing fast. By 4.45 p.m. a dense yellow fog made it almost dark—evidently London smoke rolled back by the sudden wind reversal. A paragraph in the *Westminster Gazette* of the 29th indicates a closely parallel reversal at Edinburgh just four hours previously.

Snow fell nearly all night and at 6 a.m. several measurements showed a depth of 8 inches or over. Probably fully 10 inches fell, allowing for what certainly melted. The 8 inches melted out to ·82 in.

J. EDMUND CLARK.

Asgarth, Riddlesdown Road, Purley, Surrey, April 28th, 1919.

SNOW and sleet began at 9.30 a.m. yesterday and fell lightly until the afternoon, mist and yellow fog at 4 p.m. Snow fell heavily from 7 p.m. and all night. I measured 1·71 in. at 9 a.m. this morning for the previous twenty-four hours. The depth of the undrifted snow was 8½ inches. The ground was still covered with snow at 3.30 p.m. The above are local mean times and not summer time.

E. R. TAYLOR.

Can Hatch, Burgh Heath, Tadworth, Surrey April 28th, 1919.

UNUSUAL OPTICAL PHENOMENON.

A RATHER unusual phenomenon was noticed here on Wednesday, April 23rd, at 17 h. 30 m. The sky was overcast with cirro-nebula, which was only discernible by its slight milkiness and which was evidently of no great thickness. An arc of which the colours were almost as bright as those of a rainbow, appeared not far from the zenith. I at first thought it was an arc of contact to a 46° halo, the red being on the outside, but estimated its distance from the sun at from 55° to 60°. Even supposing that I over-estimated this, it does not account for the total absence of halos, for the production of which the conditions seemed extremely favourable. I should add that there were some thin alto-cumulus clouds to the north of the arc moving from the north or north-west. I should be glad of some explanation of this.

F. HEYWOOD.

34, Longford Avenue, Stretford, Manchester, May 1st, 1919.

SNOW FOLLOWING FINE WEATHER.

Acting on Mr. Dines's suggestion, I sent him further dates, showing the same sequence, and in reply he says : "The pressure conditions on these occasions were of a very variable type, so that the simple explanation which I suggested will not go far to explain the phenomena."

Corroboration of my note followed five days after. March 10th was a warm mild day (though not sunny) with a maximum temperature of 55° ; on March 12th the wind shifted to the north, and there was a heavy snowstorm. A sudden rise of temperature with a soft warm atmosphere is frequently a signal for a cold snap. This was shown on April 18th and 19th, when there was a sudden jump to a maximum on both days of 66°. A cold north-east wind immediately followed and a minimum of 31° occurred on the 21st and 22nd.

Dollarward House, Cirencester, May 1st, 1919. C. P. HOOKER.

METEOROLOGICAL NEWS AND NOTES.

The Royal Meteorological Society, it was announced at the meeting on April 16th, contemplate holding a special summer meeting at Kew Observatory, Richmond, by the invitation of the Director of the Meteorological Office. The date has been provisionally fixed for Wednesday, July 2nd.

METEOROLOGICAL OBSERVATIONS AT LU-KIA-PANG, CHINA, FOR 1918.

By Rev. J. de Moidrey S.J.

(*concluded from page 29*).

VI.—*Rainfall.*

(*a*). INTENSITY. Days with

	mm. 0·1—0·9	1·0—2·9	3·0—4·9	5·0—9·9	10·0—19·9	20·0—39·9	40·0—59·9	60·0 & over	DAYS WITH Rain.	Snow.	Total.
Jan.	—	—	—	—	—	—	—	—			
Feb.	4	5	2	—	—	—	—	—	10	1	11
Mar.	10	2	—	1	5	1	—	—	15	—	15
April	9	1	2	5	1	1	—	—	14	—	14
May	6	3	2	2	—	—	—	—	10	—	10
June	3	4	3	1	1	1	2	—	14	—	14
July	5	—	1	1	2	2	—	1	12	—	12
Aug.	2	1	1	3	1	1	—	—	9	—	9
Sept.	3	4	2	—	1	1	—	—	11	—	11
Oct.	4	2	—	—	1	—	1	—	5	—	5
Nov.	5	3	1	1	5	1	—	—	13	—	13
Dec.	3	2	2	5	5	2	—	—	19	—	19
Year	54	27	16	19	22	10	3	1	132	1	133

VI.—(*con.*)

(*b.*) *Total Rainfall. Millimetres.*

	8 p.m. —8 a.m.	8 a.m. —8 p.m.	Total.
Jan. ..	—	—	—
Feb. ..	8·0	10·2	18·2
Mar. ..	43·5	51·9	95·4
April ..	55·0	30·3	85·3
May ..	21·7	14·8	36·5
June ..	**127·8**	**122·1**	**249·9**
July ..	74·0	88·7	162·7
Aug. ..	41·7	79·3	121·0
Sept. ..	5·5	63·8	69·3
Oct. ..	55·1	16·9	72·0
Nov. ..	51·8	71·7	123·5
Dec. ..	74·8	89·3	164·1
Year ..	558·9	639·0	1197·9

(*c.*) *Rainless Periods of 10 days or more, excluding dew.*

Began.		Ended.		Lasted.
Dec.	15, 1917	Feb.	4	52 days.
Feb.	16	Feb.	26	11 ,,
July	20	Aug.	10	22 ,,
Sept.	29	Oct.	20	22 ,,
Dec.	27	Jan.	7	12 ,,

VIII.

Mean Duration of Bright Sunshine. Hours.

	Fore-noon.	After-noon.	Total.	Per-centage of possible	Mean amount of Cloud.
Jan. ..	3·4	2·8	6·2	**60**	0·4
Feb. ..	2·2	1·7	3·9	35	0·6
Mar. ..	2·5	1·9	4·4	37	0·6
April ..	2·0	1·9	3·9	30	0·7
May ..	3·5	3·1	6·6	48	0·5
June ..	2·2	1·9	4·1	29	0·7
July ..	3·7	3·5	7·2	51	0·5
Aug. ..	4·1	3·9	8·0	**60**	0·4
Sept. ..	3·4	3·4	6·8	55	0·4
Oct. ..	3·5	3·0	6·5	57	0·4
Nov. ..	1·7	1·7	3·4	33	0·7
Dec. ..	1·2	0·9	2·1	*20*	0·8
Year ..	2·8	2·5	5·3	43	0·6

VII.—*Wind.* (*a*)

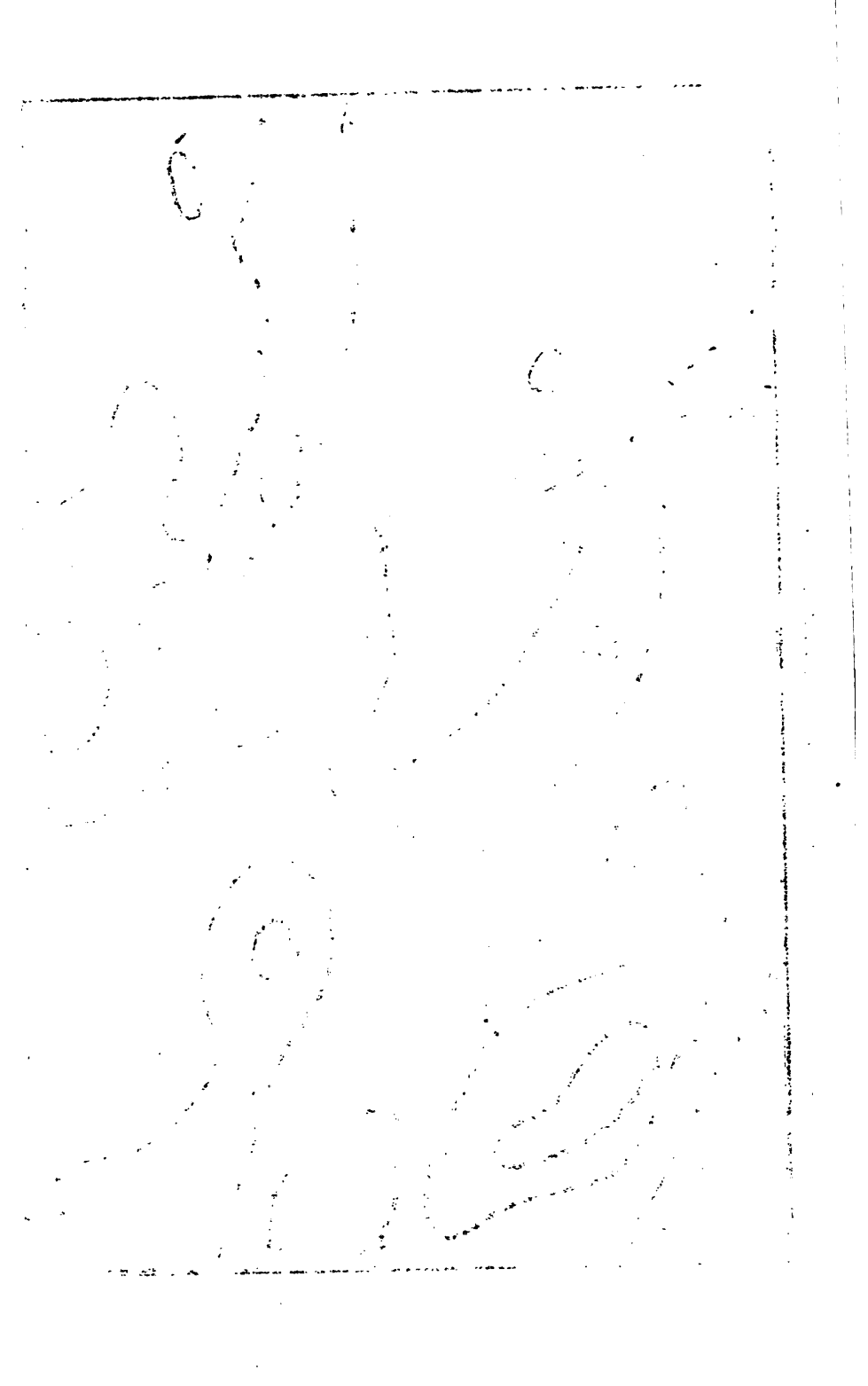
Mean Velocity at 8 a.m., 2 p.m. and 8 p.m. Metres per second.

	Mean.	Min.	Max.
Jan. ..	**4·0**	1·2	6·9
Feb. ..	3·8	2·2	7·8
Mar. ..	3·7	1·9	8·2
April ..	3·7	2·1	8·8
May ..	3·3	1·6	7·0
June ..	3·1	0·8	6·1
July ..	3·4	0·7	**9·4**
Aug. ..	—	—	—
Sept. ..	—	—	—
Oct. ..	3·1	*0·5*	6·3
Nov. ..	*2·9*	0·7	6·1
Dec. ..	3·8	1·0	6·0
Year ..	3·5	0·5	9·4

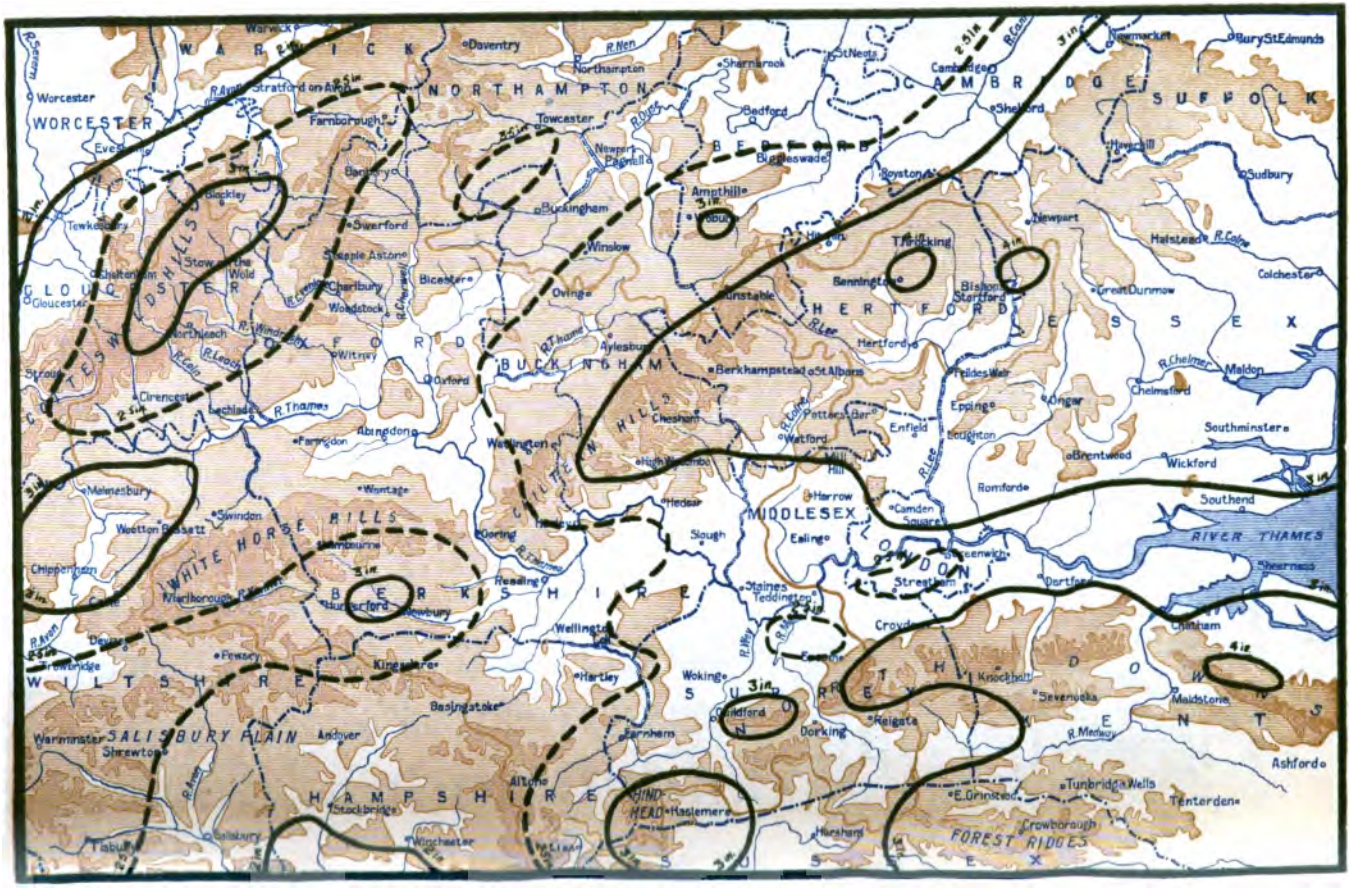
VII.—*Wind.* (*b.*) *Direction. Percentage Frequency.*

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Vari-able.
Jan.	17	9	*1*	7	3	8	9	**32**	11	3
Feb.	**28**	9	14	11	7	6	*4*	19	1	0
Mar.	13	**25**	18	16	4	5	*2*	16	1	0
April ..	13	16	19	**20**	9	7	*5*	9	0	1
May	*4*	*4*	15	**33**	11	9	5	16	3	0
June	3	*2*	10	**33**	25	10	4	4	6	1
July	7	7	16	**37**	10	*2*	8	6	5	0
Aug.	—	—	—	—	—	—	—	—	—	—
Sept. ..	*1*	9	18	**44**	20	3	*1*	2	0	0
Oct.	**23**	14	15	10	7	*4*	10	14	2	1
Nov.	21	18	11	7	6	*2*	6	**24**	3	1
Dec.	**27**	24	10	3	4	*2*	4	24	2	0
Year	14	12	**13**	**20**	10	*5*	*5*	15	3	1

The anemometer was repaired in August.



THAMES VALLEY RAINFALL APRIL 1919.



Symons's Meteorological Magazine

Isohyetals

THE WEATHER OF APRIL.

THE weather of April was of the proverbially changeable character, and, for the fourth month in succession, the mean temperature over the country generally was appreciably below the average. The deficiency of warmth last month did not, however, extend to the whole country. Along the east coasts of Great Britain the mean values were quite equal to the normal, and in a few places, *e.g.*, Aberdeen and Tynemouth, the mean of all the daily maxima was distinctly high for the time of year.

At the opening of the month when an anticyclone extended temporarily over the country from the Atlantic, sharp frost occurred in most districts, the temperatures recorded on the 1st being in some places the lowest of the whole month. After the 3rd, and for a period of nearly ten days, the winds were affected by cyclonic disturbances moving along far to the northward of these islands, and were, therefore, mainly W. or S.W., with temperatures rather above the normal. On the 7th the thermometer in the south-east of England rose slightly above 60°, and on the 11th similar readings were recorded in parts of the United Kingdom. Between the 14th and 16th the weather was influenced by a deep depression whose centre moved eastward across the northern parts of Ireland and England, the wind in its rear increasing to a gale from the N.W on many portions of our western and northern coasts. The departure of the storm system was followed by the extension of a large anticyclone from the Atlantic, and on the 18th and 19th, when a wave of warm air from the south-westward was accompanied by much sunshine, the thermometer rose to between 65° and 70° in many parts of Great Britain, and slightly exceeded 70° in a few isolated places. On the 20th a shift of wind to the N. occasioned a sudden drop in temperature, the maximum readings in the south-east of England being about 15° lower than those of the previous day. Sharp frost was experienced on the nights of the 20th and 21st, the sheltered thermometer falling below 25° in several districts, and touching 22° at Rhayader.

The cold weather continued until practically the end of the month, and between the 26th and 28th, the conditions were, for so advanced a period in the season, more inclement than in any recent year, with the exception of 1908, when a touch of winter was also experienced shortly after Easter. The disturbing influences last month were supplied by a large depression which moved southward across northern Europe and by small secondary systems which were developed over Great Britain and the North Sea. On the 27th light west winds and steady rain were followed by northerly gales and a heavy fall of snow, the depth in several parts of London and the home counties amounting to between 10 and 12 inches. On the same night a sharp frost was experienced, the thermometer falling to at least 27° in many places and reaching 22° at West Linton.

The distribution of rainfall was irregular. Less than 2 inches fell along the east coast of Great Britain from the Firth of Tay to East Anglia and along the south coast east of Selsey. The area below 2 inches also embraced the greater part of the Midlands and the north of England except the Lake District, and the Pennines. A large triangular area with more than 3 inches, including patches above 4 inches, lay to the north and east of London. Small areas in the Welsh mountains and the Lake District had more than 5 inches of rain, and in Scotland there was a considerable area west of the Caledonian Canal with more than 10 inches. In Ireland the rainfall was generally light, 2 inches being exceeded only at elevated stations. The general rainfall expressed as a percentage of the average was :—England and Wales, 124; Scotland, 138; Ireland, 72· British Isles, 113.

In London (Camden Square) the mean temperature was 45°·9, or 2°·2 below the average. The duration of sunshine was 100°·1 hours and of rainfall, 57·7 hours. It was the wettest April in 62 years' record, with the exception of April, 1878, when 4·97 in. of rain fell. The total rainfall of the first four months of 1919 was 94 per cent. above the average. Evaporation, 1·06 in.

RAINFALL TABLE FOR APRIL, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875—1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Date.	No. of Days
Camden Square	*London*	1·74	3·93	+2·19	226	1·59	27	18
Tenterden	*Kent*	1·77	3·33	+1·56	188	·89	27	13
Arundel (Patching)	*Sussex*	1·82	2·29	+ ·47	126	·58	27	11
Fordingbridge (Oaklands)	*Hampshire*	1·92	2·34	+ ·42	122	·94	13	12
Oxford (Magdalen College)	*Oxfordshire*	1·67	2·21	+ ·54	132	·83	27	16
Wellingborough (Swanspool)	*Northampn*	1·78	1·82	+ ·04	102	·64	27	16
Bury St. Edmunds (Westley)	*Suffolk*	1·62	3·56	+1·94	220	1·08	27	17
Geldeston [Beccles]	*Norfolk*	1·55	1·80	+ ·25	116	·28	15	17
Polapit Tamar [Launceston]	*Devon*	2·34	3·19	+ ·85	136	·73	14	17
Rousdon [Lyme Regis]	,,	2·39	2·28	— ·11	95	·46	14	14
Ross (Birchlea)	*Herefordshr.*	2·09	1·60	— ·49	77	·50	27	15
Church Stretton (Wolstaston)	*Shropshire*	2·20	1·73	— ·47	79	·47	15	9
Boston	*Lincoln*	1·57	2·20	+ ·63	140	·55	27	18
Worksop (Hodsock Priory)	*Nottingham*	1·62	1·70	+ ·08	105	·31	27	17
Mickleover Manor	*Derbyshire*	1·77	1·40	— ·37	79	·41	27	16
Congleton (Buglawton Vic.)	*Cheshire*	1·86	1·83	— ·03	98	·29	27	19
Southport (Hesketh Park)	*Lancashire*	1·84	1·37	— ·47	74	·22	13, 14	18
Wetherby (Ribston Hall)	*York, W.R.*	1·85	1·19	— ·66	64	·27	27	6
Hull (Pearson Park)	,, *E.R.*	1·69	1·75	+ ·06	104	·82	27	13
Newcastle (Town Moor)	*North'land*	1·84	1·79	— ·05	97	·33	14	16
Borrowdale (Seathwaite)	*Cumberland*	6·91	12·09	+5·18	175	...	...	...
Cardiff (Ely)	*Glamorgan*	2·50	2·13	— ·37	85	·58	13	20
Haverfordwest	*Pembroke*	2·82	3·18	+ ·36	113	·65	28	14
Aberystwyth (Gogerddan)	*Cardigan*	2·48	3·77	+1·29	152	·73	26	16
Llandudno	*Carnarvon*	1·79	1·97	+ ·18	110	·30	26	18
Cargen [Dumfries]	*Kirkcudbrt.*	2·50	2·20	— ·30	88	·65	13	17
Marchmont House	*Berwick*	2·28	1·45	— ·83	64	·41	27	9
Girvan (Pinmore)	*Ayr*	2·81	2·44	— ·37	87	·45	15	21
Glasgow (Queen's Park)	*Renfrew*	1·86	1·14	— ·72	61	·26	10	14
Islay (Eallabus)	*Argyll*	2·64	3·73	+1·09	141	·80	7	18
Mull (Quinish)	,,	2·98	3·92	+ ·94	131	·80	10	25
Loch Dhu	*Perth*	4·38	4·20	— ·18	96	·85	10	19
Dundee (Eastern Necropolis)	*Forfar*	1·93	2·02	+ ·09	105	·59	14	13
Braemar	*Aberdeen*	2·30	2·16	— ·14	94	·82	15	9
Aberdeen (Cranford)	,,	2·23	3·16	+ ·93	142	·81	14	17
Gordon Castle	*Moray*	1·74	3·08	+1·34	177	...	...	...
Drumnadrochit	*Inverness*	1·85	3·99	+2·14	215	·70	25	23
Fort William	,,	3·65	7·77	+4·12	213	2·57	10	25
Loch Torridon (Bendamph)	*Ross*	4·70	10·84	+6·14	231	2·03	10	25
Dunrobin Castle	*Sutherland*	2·02	2·70	+ ·68	134	·50	27	17
Glanmire (Lota Lodge)	*Cork*	3·23	1·25	—1·98	39	·43	14	14
Killarney (District Asylum)	*Kerry*	3·46	2·98	— ·48	86	·82	14	25
Waterford (Brook Lodge)	*Waterford*	2·68	1·13	—1·55	42	·25	13	12
Nenagh (Castle Lough)	*Tipperary*	2·54	1·65	— ·89	65	·38	13	20
Ennistymon House	*Clare*	2·81	1·78	—1·03	63	·27	26	20
Gorey (Courtown House)	*Wexford*	2·37	1·46	— ·91	62	·26	3	14
Abbey Leix (Blandsfort)	*Queen's Co.*	2·54	1·45	—1·09	57	·31	14	16
Dublin (Fitz William Square)	*Dublin*	2·03	·90	—1·13	44	·22	26	17
Mullingar (Belvedere)	*Westmeath*	2·37	1·77	— ·60	75	·35	12	14
Crossmolina (Enniscoe)	*Mayo*	3·13	3·68	+ ·55	118	·39	9, 26	24
Cong (The Glebe)	,,	...	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	2·52	3·10	+ ·58	123	·38	26	25
Seaforde	*Down*	2·76	1·46	—1·30	53	·56	13	13
Ballymena (Harryville)	*Antrim*	2·57	2·32	— ·25	90	·39	13	20
Omagh (Edenfel)	*Tyrone*	2·50	2·10	— ·40	84	·26	25	24

SUPPLEMENTARY RAINFALL, APRIL, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Sevenoaks, Speldhurst Av....	3·14	XI.	Lligwy	1·79
,,	Ramsgate	2·66	,,	Douglas, Isle of Man	2·31
,,	Hailsham	2·90	XII.	Stoneykirk, Ardwell House...	2·08
,,	Totland Bay, Aston House...	1·37	,,	Carsphairn, Shiel	4·29
,,	Stockbridge, Ashley..	2·12	,,	Langholm, Drove Road	3·10
,,	Grayshott	3·07	XIII.	Selkirk, The Hangingshaw..	3·01
,,	Upton Nervet	2·15	,,	North Berwick Reservoir.....	2·27
III.	Harrow Weald, Hill House...	2·76	,,	Edinburgh, Royal Observaty.	3·03
,,	Pitsford, Sedgebrook.....	1·77	XIV.	Biggar.....	4·09
,,	Woburn, Milton Bryant.....	3·11	,,	Maybole, Knockdon Farm ...	2·01
,,	Chatteris, The Priory.....	2·18	XV.	Shiskine	2·79
IV.	Elsenham, Gaunts End	3·65	,,	Ardgour House	12·63
,,	Rayleigh	...	,,	Oban.....	3·88
,,	Colchester, Hill Ho., Lexden	3·34	,,	Holy Loch, Ardnadam.....	3·97
,,	Aylsham, Rippon Hall	2·19	,,	Loch Venachar	2·70
,,	Swaffham	1·87	XVI.	Glenquey	2·90
V.	Bishops Cannings	2·45	,,	Loch Rannoch, Dall	2·03
,,	Weymouth.....	1·43	,,	Blair Atholl	1·49
,,	Ashburton, Druid House.....	1·71	,,	Coupar Angus	1·59
,,	Cullompton	2·60	,,	Montrose, Sunnyside Asylum.	3·15
,,	Lynmouth, Rock House	2·86	XVII.	Balmoral	3·28
,,	Okehampton, Oaklands.....	4·02	,,	Fyvie Castle	2·47
,,	Hartland Abbey.....	1·96	,,	Keith Station	4·77
,,	St. Austell, Trevarna	4·10	XVIII.	Rothiemurchus	3·69
,,	North Cadbury Rectory.....	2·35	,,	Loch Quoich, Loan	26·80
VI.	Clifton, Stoke Bishop	2·21	,,	Skye, Dunvegan	6·41
,,	Ledbury, Underdown..... ...	1·83	,,	Fortrose.....	3·25
,,	Shifnal, Hatton Grange.....	2·05	,,	Glencarron Lodge	11·43
,,	Droitwich.....	1·90	XIX.	Tongue Manse	4·32
,,	Blockley, Upton Wold.....	3·15	,,	Melvich	2·92
VII.	Grantham, Saltersford.....	1·87	,,	Loch More, Achfary	14·42
,,	Louth, Westgate	1·91	XX.	Dunmanway, The Rectory ..	3·02
,,	Bawtry, Hesley Hall	1·55	,,	Mitchelstown Castle.....	1·61
,,	Derby, Midland Railway.....	1·20	,,	Gearahameen	6·50
VIII.	Nantwich, Dorfold Hall	2·13	,,	Darrynane Abbey.....	2·60
,,	Bolton, Queen's Park	3·11	,,	Clonmel, Bruce Villa	1·63
,,	Lancaster, Strathspey	1·74	,,	Roscrea, Timoney Park	1·61
IX.	Langsett Moor, Up. Midhope	1·60	,,	Broadford, Hurdlestown.....	1·83
,,	West Witton	1·86	XXI.	Enniscorthy, Ballyhyland...	1·96
,,	Scarborough, Scalby	2·13	,,	Rathnew, Clonmannon	1·16
,,	Ingleby Greenhow	2·20	,,	Hacketstown Rectory	2·45
,,	Mickleton	...	,,	Ballycumber, Moorock Lodge	1·19
X.	Bellingham, High Green Manor	2·22	,,	Balbriggan, Ardgillan	1·25
,,	Ilderton, Lilburn Cottage ...	1·85	,,	Castle Forbes Gardens.....	1·78
,,	Keswick, The Bank.....	3·34	XXII.	Ballynahinch Castle.....	3·14
,,	Orton.....	2·95	,,	Woodlawn	·60
XI.	Llanfrechfa Grange	1·84	,,	Westport House	2·74
,,	Treherbert, Tyn-y-waun	4·57	,,	Dugort, Slievemore Hotel ...	6·03
,,	Carmarthen, The Friary	2·05	XXIII.	Enniskillen, Portora.....	1·89
,,	Fishguard, Goodwick Station.	1·71	,,	Dartrey [Cootehill]	...
,,	Crickhowell, Tal-y-maes.....	3·30	,,	Warrenpoint, Manor House ..	1·18
,,	Birmingham WW., Tyrmynydd	3·90	,,	Belfast, Cave Hill Road	1·55
,,	Lake Vyrnwy	3·57	,,	Glenarm Castle	2·02
,,	Llangynhafal, Plas Drâw.....	2·65	,,	Londonderry, Creggan Res...	3·15
,,	Rhiwbryfdir	7·67	,,	Milford Manse	2·87
,,	Dolgelly, Bryntirion.....	4·92	,,	Killybegs	...

ERRATA.—Plas Drâw, 4·70 should be 6·70 in March.

Climatological Table for the British Empire, November, 1918.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	57·8	1	28·5	9	49·1	37·1	40·6	91	60·5	24·6	2·21	16	7·7
Malta	77·0	9	52·0	30	67·3	58·9	...	85	121·5	43·0	4·67	14	7·5
Lagos	98·3	7	70·0	4	89·2	76·0	75·2	76	161·3	67·0	2·05	7	6·1
Cape Town	94·0	3	44·8	19	74·3	55·0	52·5	65	...	...	2·19	9	3·7
Johannesburg	82·6	7	43·8	3	74·4	54·0	48·5	64	...	43·0	4·24	13	5·3
Mauritius	86·4	*29	63·2	25	82·6	67·8	63·2	69	...	56·2	1·35	11	5·5
Bloemfontein	88·5	6	40·7	16	80·5	52·3	49·6	53	..	...	2·56	9	4·1
Calcutta...	90·3	5	57·7	26	84·5	65·2	63·0	69	...	48·4	·04	1	4·0
Madras	87·6	23	70·9	11	83·7	75·0	75·8	88	161·6	60·5	39·18	23	7·6
Colombo, Ceylon ...	88·9	3	71·7	7	86·5	74·2	73·6	83	159·2	68·1	5·10	21	7·4
Hongkong	82·5	6	59·7	19	72·7	66·1	62·5	78	...	...	5·08	13	7·6
Sydney	94·3	14	49·7	29	73·2	59·6	54·4	66	139·0	45·0	1·27	10	5·8
Melbourne	94·0	23	39·8	18	68·9	50·1	46·5	60	144·2	31·0	·52	7	5·4
Adelaide	97·5	22	44·1	5	79·2	54·6	48·0	46	155·0	31·7	·26	4	3·7
Perth	94·6	24	48·0	13	77·0	59·2	55·8	65	156·4	37·1	·52	12	5·0
Coolgardie	102·5	21	49·8	13	88·9	59·0	46·4	32	167·0	47·2	·00	0	3·1
Brisbane	92·3	1	56·5	30	84·0	64·4	61·1	65	153·5	51·6	2·16	7	4·3
Hobart, Tasmania ..	84·4	9	39·2	29	64·0	48·4	43·4	59	146·0	32 9	1·28	14	6·0
Wellington	69·7	14	40·2	4	61·5	49·9	47·1	73	151·0	30·1	3·34	11	6·4
Jamaica, Kingston ..	90·3	15	66·1	9	87·3	70·7	69·2	79	...	...	·71	3	3·8
Grenada	86·0	5, 26	73·0	‡29	84·0	75·0	...	80	135·0	...	6·54	25	4·5
Toronto	65·7	7	17·8	26	48·4	35·5	35·3	85	116·9	14·0	1·34	15	7·2
Fredericton	58·0	1	12·0	‡26	40·8	26·1	27·6	79	...	...	3·90	11	5·9
St. John, N.B. ...	54·7	1	13·5	27	42·1	31·1	30·3	76	108·7	10·7	5·34	11	5·7
Victoria, B.C.	54·5	5	34·0	‡26	49·3	41·5	41·0	86	110·0	24·0	3·28	18	7·4

*and 30. † 10. ‡ 27.

Johannesburg.—Bright sunshine 261·3 hours.

COLOMBO, CEYLON.—Mean temp. 80°·3, or 0°·8 above, dew point 0°·7 above, and R 5·84 in. below, averages. Mean hourly velocity of wind 2·6 miles. TS on 30th.

HONGKONG.—Mean temp. 69°·2. Bright sunshine 124·6 hours. Mean hourly velocity of wind 11·3 miles.

Melbourne.—Mean temp. 1°·8 below, and R 1·75 in. below, averages.

Adelaide.—Mean temp. normal and R ·91 in. below average.

Perth.—R ·25 in. below average.

Coolgardie.—Temp. 3°·2 above the average.

Brisbane.—Temp. 0°·2 above average.

Wellington.—Mean temp. 1°·2 below, and R ·22 in. below, averages. Bright sunshine, 191·8 hours. Heavy N.W. gale on 7th.

Symons's Meteorological Magazine.

No. 641. JUNE, 1919. Vol. LIV.

Richard Henry Curtis.

1847—1919.

The death of Mr. R. H. Curtis takes away one more of the rapidly diminishing band of veteran meteorologists whose professional careers date back to the earliest days of the Meteorological Office. In this magazine for April, 1912 (p. 53), we chronicled the retirement of Mr. Curtis from the Meteorological Office after a period of service extending to 51 years, and we refer our readers to that volume for the portrait which want of space prevents our reproducing. Mr. Curtis entered the Meteorological Department of the Board of Trade under Admiral Fitzroy in 1861. He was at first in the Telegraph Room, which afterwards became the Forecast Branch, and later in the Marine Department where he was a colleague of the late Mr. G. J. Symons until the latter left to take up his life-work at Camden Square. Mr. Curtis's great aptitude for devising and improving instruments led naturally to his appointment in 1907 as Superintendent of Instruments and Observatories, a position which he held until his retirement in 1912. During this period he made a special study of sunshine recording and introduced an improvement in the mounting of the Campbell-Stokes sunshine recorder which is now regarded as the standard form. He also carried out experiments on the distribution of wind-pressure on flat surfaces. The information thus gained was recently put to a severe practical test in the design of an automatic apparatus for warnings of dangerous wind velocities used on some Irish Light Railways. This apparatus was said to work better than any other designed for a similar purpose.

For the last 15 years or so of his life Mr. Curtis lived at Warlingham, where he carried on meteorological observations regularly until compelled to give them up a few weeks before his death.

He was for long a Fellow of the Royal Meteorological Society and was a valued member of the Council for many years.

THE ZODIACAL LIGHT.

By the late COMMANDER M. W. CAMPBELL HEPWORTH, R.N.R., C.B.

RECENT numbers of the Meteorological Office Circular include correspondence with reference to the Zodiacal Light. The present writer therein suggests that the cosmic matter from which the light is reflected may surround the earth, instead of being an appendage of the sun. The well known astronomer, the Rev. Marc Dechevrens, writes, expressing his opinion, in the Circular, that the Zodiacal Light pertains to the sun not to the earth.

Perhaps among the numerous readers of your Magazine, there may be some who, having been interested observers of the zodiacal light, would add their own opinions in this matter.

The principal reason for my belief that the cosmic matter from which the light is reflected pertains to the earth is that it is visible on every clear moonless night in the tropics, as a band of nebulous light stretching across the sky from the western to the eastern horizon, and *vice versa*, whereas Father Dechevrens bases his argument for the opposite view, mainly upon the supposition that the phenomenon can be seen only at certain periods during the year.

The accompanying notes relating to the Zodiacal Light are culled from three meteorological logs, which were contributed by myself to the Meteorological Office in the years 1898 and 1899, in which frequent entries are made of such occurrences.

The Rev. Marc Dechevrens is one of the leading astronomers of the day; his opinions, therefore, command every consideration. Displays of the Zodiacal Light, however, do not assume the same brilliancy in temporate latitudes as they do in tropical regions; I have the less hesitation, therefore, in differing from him in this connection.

Observations of the Zodiacal Light.

(Extracted from a Meteorological Log kept on board the R.M.S. *Aorangi*, by M. W. C. HEPWORTH, Lieut, R.N.R., Commander)

1899—August :—

8th	Noon	2° 47′ N.	168° 49′ W.
9th	Noon	2° 22′ S.	171° 33′ W.
10th	Noon	7° 38′ S.	174° 7′ W.

For several nights Zodiacal Lights have been visible from sunset to sunrise, reaching entirely across the sky, with a breadth of from from 18° to 23°, perfectly distinct and clearly outlined.

1898—November :—

30th	8—8.30 p.m. ..	2° 13′ S.	171° 54′ W.

December :—

1st	8—9 p.m. ..	7° 23′ S.	174° 28′ W.

Zodiacal Lights very distinct showing plainly from western horizon to a little beyond the zenith and faintly onwards to the eastern horizon, thus being visible from Sagittarius through the successive Zodiacal constellations to Gemini, Pisces being in the zenith.

2nd ..... 8—9 p.m. .. 11°42′ S. 176° 27′ W.
Zodiacal Lights very distinct (as on the two previous nights) until moonrise at 10.15 p.m. extending from Scorpio to Gemini.

7th ..... 8.15—10.15 p.m. 30° 1′ S. 178° 53′ E.
Zodiacal Lights visible from Scorpio in Lr. S.W. to Taurus in N.E.

13th ..... 8.30 p.m. to mdnt. 34° 30′ S. 153° 30′ E.
Zodiacal Lights appear over and across western horizon, shining moderately brightly from Aquarius to Taurus and gradually setting.

Occasions on which the Zodiacal Light was visible but did not extend between E. and W. horizon across the celestial Concave.

1899—January :—

9th	8—10 p.m. ..	20° 33′ S.	178° 3′ E.
10th	8—9 p.m. ..	17° 1′ S.	178° 14′ E.
10th	7—9.30 p.m. ..	12° 43′ S.	176° 59′ W.
11th	8 p.m. ..	8° 18′ S.	174° 24′ W.
12th	7.30—11 p.m...	3° 0′ S.	172° 4′ W.
13th	7.30—10 p.m ..	1° 39′ N.	169° 50′ W.
14th	8.30—11 p.m.	6° 6′ N.	167° 13′ W.
15th	10—11 p.m. ..	11° 12′ N.	163° 52′ W.
16th	11—midnight..	15° 14′ N.	161° 9′ W.

1898—June :—

14th	6—8 p.m. ..	2° 7′ N.	169° 41′ W.

Remarkably bright in south.

16th	7—8 p.m. ..	8° 23′ S.	175° 7′ W.

1897—December :—

21st	From	
	23° 49′ N.	155° 34′ W.
22nd	to	
23rd	13° 31′ N.	162° 52′ W.
24th		

During the evenings of the 21st, 22nd, 23rd and 24th, the Zodiacal Lights were most distinctly visible from the horizon, in Sagittarius, through Capricornus, Aquarius, Pisces, gradually growing fainter and more indistinct, but still to be traced into Aries and even Taurus on the opposite side of the Zenith. Again each of these mornings just before sunrise they were very distinct from Sagittarius, through Scorpio, Libra, Virgo, until lost in Leo, almost at the zenith. Thus in the course of 24 hours they could be seen through ten out of the twelve "Signs of the Zodiac."

On the 22nd, at 8 p.m., Zodiacal Lights were very clearly visible to an altitude of 80°.

May :—

19th ..... 6—8.45 p.m. .. 5° 35′ S. 173° 30′ W.
Zodiacal Lights faintly visible in east to an altitude of 60°.

20th ..... 7.45—8.45 p.m. 2° 37′ S. 171° 30′ W.
Zodiacal Lights faintly visible.

June :—

28th ..... 7 p.m. .. 11° 42′ 162° 26′ W.
Zodiacal Lights brilliant from W.S.W. to N. by W. at altitude 40°.

Correspondence.

To the Editor of Symons's Meteorological Magazine

THE SPRING EQUINOX.

In the Weather Report in *The Times* of March 22nd is the following passage :—"The incursion of the present type of weather with north-east winds, dull weather, and occasional sleet or snow, about the vernal equinox, usually portends the persistence of similar conditions over several days."

I have so often noticed the occurrence of snow at the period of the vernal equinox that I once drew the attention of a more experienced meteorologist than myself to the matter, but he said it was a mere coincidence. I think it is more than a coincidence, and that there must be some cause connected with the equinox itself to bring it about or why should it be such a frequent happening? In some years, after winters which have been almost snowless, the inevitable fall has occurred about March 21st.

I have looked up old weather registers for the last 100 years, (Luke Howard, 1820-9, a well kept register in Suffolk, 1830 to 1882, and my own, from 1883 to 1919), and find that in the 100 years snow is reported as having fallen between March 18th and 25th in no less than 52 years. What is the explanation?

Christchurch Lodge, Eaton, Norwich. ARTHUR W. PRESTON.

DEW PONDS.

I was very glad to see the letter from Dr. J. R. Sutton in your last number because in the interest of scientific accuracy it is most desirable that the statements made by Mr. Hubbard in his communication to the Institute of British Architects regarding the maintenance of ponds by dew or mist should be corrected. It is strange how this belief persists and what evidence is considered good enough to bring forward in its support. Mr. Hubbard's paper is full of statements for which there is really no satisfactory evidence whatever. For example, he accepts without question the story of the shepherd who measured a rise of eight inches in five rainless nights on a "dew pond"! Few people, however, take the trouble to weigh evidence and the miraculous has great attractions for many of us. But there is really no mystery about the maintenance of the so-called dew ponds. They are merely rain water receptacles and they are maintained because the rainfall affecting them is greater than the evaporation. This would be so even if they had no area draining to them, but this is never the case. I will take as an

example, the well known pond on the Downs, near Patcham, in Sussex. This pond has a water surface of 6,361 square feet, and a margin draining to it 15 feet in width. The area upon which the amount of rainfall must be calculated is therefore 10,568 sq. feet. The evaporation, taken on the area of the water surface, is based upon the records of the late Mr. Baldwin Latham, at Croydon.

The following table gives the profit and loss account in an average year, taking the rainfall at 30 inches which is somewhat under the mark :—

Month.	Rainfall.	Evaporation from Water Surface.	Rainfall.	Evaporation from Water Surface.	Difference.
	Inches.		Gallons.		
Jan. ...	2·13	0·25	11,728	828	10,900
Feb. ...	2·13	0·34	11,728	1,126	10,602
Mar. ...	2·07	0·94	11,397	3,113	8,284
April...	2·01	1·80	11,067	5,962	5,105
May ...	2·07	2·70	11,397	8,942	2,455
June ...	2·64	3·12	14,536	10,333	4,203
July ...	2·73	3·30	15,031	10,930	4,101
Aug. ...	2·64	2·70	14,536	8,942	5,594
Sept....	2·34	1·50	12,884	4,968	7,916
Oct. ...	3·51	0·82	19,326	2,716	16,610
Nov. ...	3·09	0·43	17,014	1,424	15,590
Dec. ...	2·64	0·23	14,536	762	13,774
Totals	30·00	18·13	165,180	60,046	105,134

These figures show a balance over the whole year of upwards of 105,000 gallons, or for the six months, April to September, of more than 28,000 gallons, equal to 150 gallons a day due to the increment alone. If to this be added the contents of the pond at an average depth of two feet, we have 108,000 gallons available during the six months for watering sheep or cattle, or nearly 600 gallons a day. In a year of average rainfall, therefore, it is not to be wondered at that the pond should easily last the summer through. It is well known, however, that these ponds fall very low in exceptionally dry years. Such a year was 1911. In that year the profit and loss account, worked out in the same way as for an average year, shows that so far from there being a balance of rainfall over evaporation on the Patcham Pond in the six months, April to September, there was a loss of nearly 8,000 gallons. Notwithstanding this, if the pond were perfectly watertight, and unless the draught upon it were very heavy, it would not fail. It follows that there is no reason to look for any cause other than rainfall for the replenishment of ponds of the character dealt with by Mr. Hubbard in his paper.

5, Queen Anne's Gate, May 30th, 1919. W. VAUX GRAHAM.

SUMMER AND WINTER TEMPERATURE VARIATIONS.

ALMOST as important as the difference in the general level of temperature between the summer and winter solstitial periods is the different type of temperature variation at the two seasons. It is well known, of course, though hardly sufficiently realized as a climatic contrast, that the diurnal range of temperature is large in summer but small in winter, and this, I suppose, is a good natural illustration of the law of cooling. In summer while the variation of temperature between day and night is very marked, the day to day vicissitudes, except when a sudden change in the type of weather occurs are not prominent. In winter, on the other hand, while the diurnal range is small the irregular non-periodic fluctuations of temperature associated with cyclonic wind changes are very conspicuous, with the result that the highest temperature of the "day" not infrequently occurs during the night. The latter occurrence is often quoted as something paradoxical, whereas viewed in the proper climatic light it should be regarded as quite a characteristic seasonal contingency between November and February. I do not know how often the highest temperature for the twenty-four hours has occurred during the night between May and August, but the instances must be very few relatively, and limited presumably to the occasions of a sudden change to a colder type of weather taking place in the early morning hours.

L. C. W. BONACINA.

27, Tanza Road, Hampstead, N.W. 3, June 3rd, 1919.

THUNDERBOLT AT DETLING.

THE following account is from the *Kent Messenger* of April 12th, 1919.

> What is generally termed a "thunderbolt" caused some alarm during the thunderstorm on Wednesday afternoon, when about three o'clock, it fell on Detling Hill. The occupants of a motor lorry belonging to Messrs. Style and Winch were coming down the hill, when, following an unusually vivid flash of lightning and a heavy crash of thunder, they saw what appeared to be a flaming hot cannon ball shoot across the road just in front of them, smash through some "spiles," or fencing, and cut a tree before taking to earth with a violent explosion. This must not be confused with the ordinary meteorite, but is regarded as an interesting instance of what is known scientifically as "ball-lightning," an as yet unexplained phenomenon.

Men are trying to dig it out for preservation in the Maidstone Museum. The hole in the ground is about 2 inches in diameter. This I had from the men who are digging.

RICHARD COOKE.

The Croft, Detling, Maidstone, April 14th 1919.

MAMMATO-CUMULUS CLOUD.

REFERRING to the letter on Mammato-Cumulus in your last number, I may say these clouds are not infrequent in southern France; but they are of little value for forecasting weather, because they appear in the rear of thunderstorms or local squalls. To my mind, the Mammato-Cumulus seen in southern France indicates a reversal of the normal air currents, going downwards, in fact, and the festooned appearance suggests the crest of a wave breaking towards the earth.

I never saw the *pocky* or *mackerel* sky described in English meteorologies.

M. MOYE.

12, rue du Faubourg-Boutonnet, Montpellier, France. May '21st, 1919.

ROYAL METEOROLOGICAL SOCIETY.

A MEETING of this Society was held on May 21st, at 70, Victoria Street, S.W., Sir Napier Shaw, F.R.S., President, in the Chair.

A paper by Capt. C. J. P. Cave, and Mr. J. S. Dines, entitled, "Further Measurements on the Rate of Ascent of Pilot Balloons," was read by Mr. Dines. The paper discussed experiments made in the Albert Hall, in which a clear height of 40 metres is available from floor level to the grid at the centre of the domed roof. The formula in general use for the rate of ascent is, Rising Velocity, $V = q.\sqrt{L} \div \sqrt[3]{W + L}$, where L = the free lift and W the dead weight of the balloon and q is a constant the value of which has to be determined under different conditions. It had been suggested that the value of q varied with different degrees of loading of the balloon. Attention was directed to this question and quantitive results obtained. Measurements were also made with a candle lantern of the pattern used for night ascents hung below the balloon. It was found that this produced no effect upon q. In timing the rate of ascent in closed buildings a fine thread has generally been attached to the neck and has been drawn up from the floor as the ascent proceeded. In the present case experiments which were made with and without such a thread showed that some correction is necessary where a thread is used. The general results confirmed the value $q = 84$, which is used at the present time, for balloons of the size generally adopted for pilot balloon work. This value gives velocities in metres per minute when lift and deadweight are expressed in grammes.

In the discussion which followed Lieut.-Col. Gold said that a considerable difference might exist between the rates of ascent in the open air and in a closed room. It would be of advantage if experiments could be conducted alongside the Eiffel Tower (400 metres high) with Observers stationed on each platform. He carried out experiments with two theodolites in France, and the resulting rates of ascent varied from 100 to 300 metres per minute. Sir

Napier Shaw thought the fact that several ascents were considered necessary for any conclusive result was very disturbing. It was desirable to devise a means of insuring the balloon rising in a straight line. Messrs. Bryant, Hopkinson and Silvester also spoke.

"The Report on the Observations for the Phenological Year, December, 1917, to November, 1918," by Mr. J. Edmund Clark and Mr. H. B. Adames was also presented. The excessive cold of December, 1917, was followed by three mild months. By April 1st blackthorn was in most parts blooming, and rarely had the farm and garden promise at this date been so satisfactory. The mid-April bitter weather was disastrous to the opening fruit tree buds, and a continuation of summer drought and coolness continued the prejudicial conditions. A genial August greatly favoured the earlier harvest districts, but the excessive wet in September caused damage and loss elsewhere. The whole autumn was cool, but comparative dryness in October and November helped finally in the harvesting of nearly average field crops. Potatoes gave a record for acreage and yield per acre. The migrant records supported the interesting weather relationships shown by the other tables. The isophenal lines on the map indicated the districts where plants blossomed simultaneously. Their course showed the marked influence of elevation. On the same map were also shown the isotherms for the first half of the year. The effect of the war was felt in the loss of many Observers who formerly contributed to this report and an increase in the present numbers is to be desired, particularly in the northern districts and in Ireland.

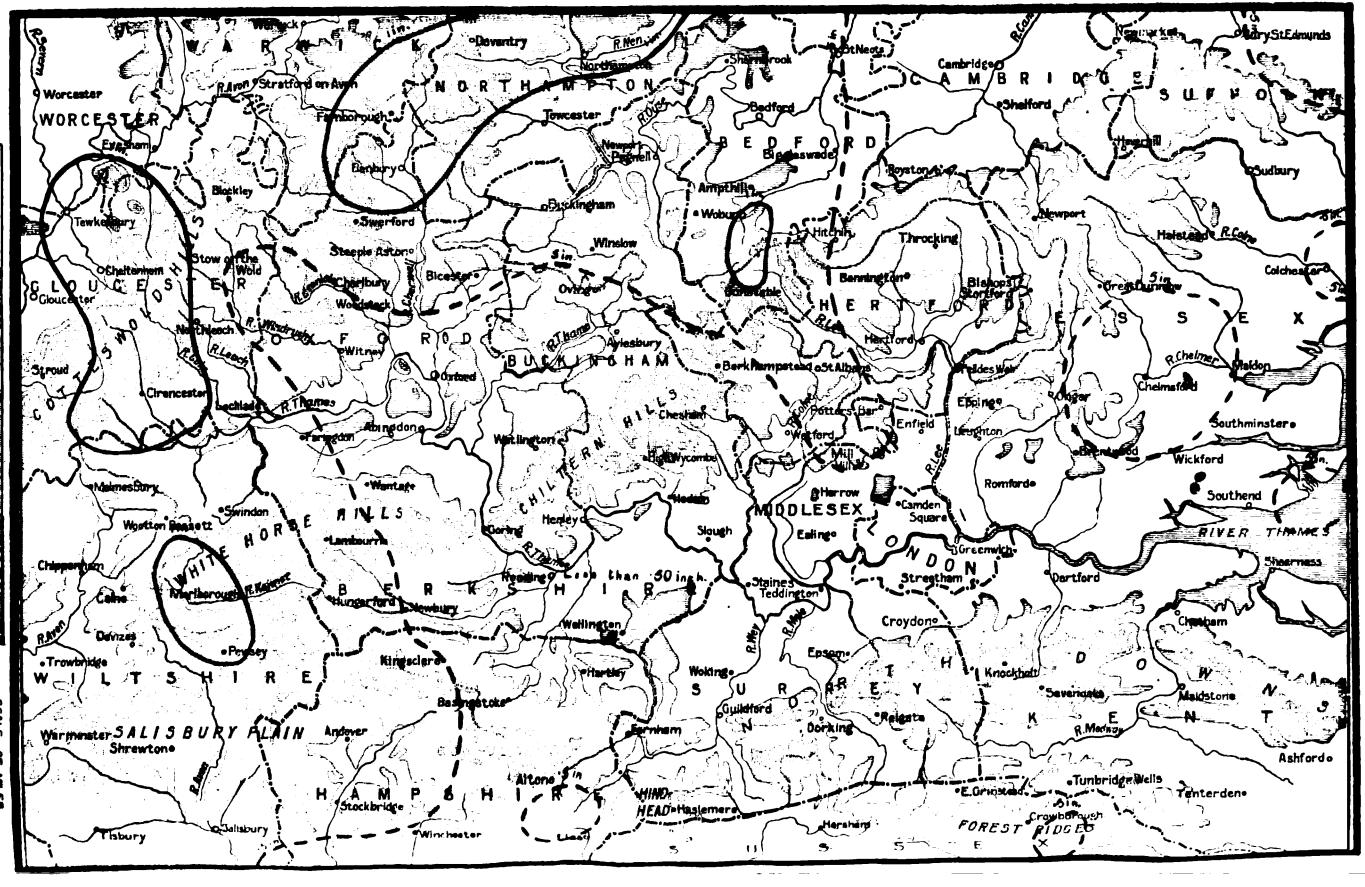
Lieut.-Col. Gold suggested that the results of the long series of observations should be summarised in the form of a general survey of the subject of phenology. The isotherms and the isophenes should be given on different charts with the addition of sunshine values.

The following were elected Fellows of the Society :—Lieut. H. W. L. Absalom, R.E., E. V. Bacon, M.B.E., M.A., S. S. Burlingham, G. O. Capell, R.A.F., Admiral R. B. Farquhar, C.B., Miss E. H. Geake, M.Sc., A. J. Grant, G. B. Hamlin, Comm. G. Robinson Hudson, R.N.R., C. W. Lamb, Capt. P. A. Smee, R.A.F.

METEOROLOGICAL NEWS AND NOTES.

Meteorological Libraries.—The Council of the Royal Meteorological Society desire to call attention to the desirability of establishing meteorological libraries in important centres throughout the country. For this purpose they would suggest to those who possess series of meteorological publications, for which they have no permanent use, that they should offer them to form a nucleus for a library in some suitable place. The Society is prepared to supplement such libraries on the understanding that they will be ultimately available for public use.

THAMES VALLEY RAINFALL. MAY. 1919.


ALTITUDE SCALE
Below 250 feet
250 to 500 feet
500 to 1000 feet
Above 1000 feet
SCALE OF MILES
Less than 30 inch.
WORCESTER
GLOUCESTER
WILTSHIRE
HAMPSHIRE
BERKSHIRE
OXFORD
BUCKINGHAM
NORTHAMPTON
BEDFORD
HERTFORD
MIDDLESEX
LONDON
SURREY
KENT
SUSSEX
ESSEX
SUFFOLK
CAMBRIDGE
Worcester
Evesham
Tewkesbury
Cheltenham
Gloucester
Stroud
Cirencester
Tetbury
Malmesbury
Swindon
Wootton Bassett
Chippenham
Calne
Marlborough
Devizes
Trowbridge
Pewsey
Warminster
Shrewton
Salisbury
Tisbury
Andover
Stockbridge
Basingstoke
Kingsclere
Newbury
Hungerford
Lambourn
Wantage
Abingdon
Witney
Oxford
Woodstock
Chipping Norton
Bicester
Banbury
Daventry
Stratford on Avon
Warwick
Rugby
Towcester
Northampton
Wellingborough
Olney
Newport Pagnell
Buckingham
Winslow
Aylesbury
Thame
Wallingford
Reading
Henley
Marlow
High Wycombe
Chesham
Amersham
Watford
Harrow
Slough
Windsor
Staines
Teddington
Ealing
Hounslow
Kingston
Wokingham
Bracknell
Ascot
Woking
Guildford
Godalming
Farnham
Haslemere
Petersfield
Alton
Winchester
Basingstoke
Andover
Luton
Dunstable
Hitchin
Baldock
Royston
Bedford
Biggleswade
Ampthill
Wobum
Berkhamsted
St. Albans
Hertford
Ware
Bishop's Stortford
Newport
Saffron Walden
Great Dunmow
Braintree
Halstead
Colchester
Sudbury
Haverhill
Newmarket
Bury St. Edmunds
Cambridge
St. Neots
Sharnbrook
Barnet
Enfield
Edmonton
Tottenham
Hackney
Finsbury
Islington
Paddington
Kensington
Chelsea
Battersea
Wandsworth
Putney
Richmond
Kew
Brentford
Hanwell
Uxbridge
Harrow
Hendon
Hampstead
Camden Square
Willesden
Acton
Ealing
Chiswick
Hammersmith
Fulham
Clapham
Streatham
Croydon
Epsom
Leatherhead
Dorking
Reigate
Redhill
Godstone
Oxted
Limpsfield
Westerham
Sevenoaks
Knockholt
Orpington
Bromley
Beckenham
Penge
Dulwich
Camberwell
Peckham
Deptford
Greenwich
Woolwich
Plumstead
Erith
Dartford
Crayford
Bexley
Sidcup
Chislehurst
Bromley
Maidstone
Chatham
Rochester
Gravesend
Tilbury
Southend
Shoeburyness
Wickford
Romford
Ilford
Leyton
Walthamstow
Tottenham
Edmonton
Enfield
Barnet
Elstree
Watford
Rickmansworth
Uxbridge
Staines
Windsor
Eton
Slough
Maidenhead
Henley
Wallingford
Abingdon
Oxford
Witney
Chipping Norton
Banbury
Daventry
Rugby
Nuneaton
Coventry
Leamington
Warwick
Stratford on Avon
Evesham
Worcester
Malvern

THE WEATHER OF MAY.

OVER by far the greater part of Great Britain a marked predominance of anticyclonic weather resulted last month in one of the warmest and driest Mays on record. In Ireland, where the conditions were influenced very frequently by cyclonic systems moving over the Atlantic, the weather was of a more normal character.

During the opening week the effect of the oceanic disturbances was felt more or less over the United Kingdom generally, the winds being mainly from S. or S.W., and the weather changeable and rather cool. On the night of the 3rd a sharp ground frost occurred over North Britain, the exposed thermometer falling to a minimum of 19° at Balmoral and 21° at Crathes (Kincardineshire).

After the 6th barometic pressure became high in the north, and easterly winds therefore set in, slight ground frosts being experienced on the night either of the 7th or 8th in many localities, as far south as Greenwich. Between the 9th and 11th, when a shallow depression spread over the country from the south-westward, the conditions were again rather changeable. Thunderstorms occurred in the London district and some other portions of the south-eastern counties on the 9th, and at a number of western and northern stations on the 11th. After the latter date the type of weather in all but the western and south-western districts was almost continuously anticyclonic, the highest pressures being situated at first over northern Europe, afterwards over the North Sea, and finally over the United Kingdom. An extension of fine sunny weather proceeded in a similar fashion, and with winds blowing mainly from some easterly quarter the air became exceedingly dry. During the last fortnight there were many days upon which the relative humidity fell below 50 per cent.; at Kew and Leith there were five days on which it fell below 40 per cent., and at Eskdalemuir there were 6 days on which it fell below 30 per cent. In nearly all districts temperature rose to a very high level for the time of year. On the 23rd shade maxima of 80° or slightly more were recorded over eastern and central England, and towards the close of the month readings only a trifle below that level were observed in nearly all parts of the United Kingdom. At many English stations the mean of all the daily maxima for the month was more than 6° above the average, the value at Kew being the highest recorded in May, as far back at all events as 1871.

The effect of a warm air blowing over the cool sea surface was seen in a considerable prevalence of coastal fog, and at a few places in the west and south-west the total duration of bright sunshine was below the average. Over the country generally there was, however, a large excess.

The month was remarkably dry over the whole of Great Britain, the deficiency exceeding 75 per cent. of the average in the south and east of England, in Glasgow and the north of Scotland. The total fall was less than ·50 inch over a great part of the Thames Valley and East Anglia, and exceeded 2 inches only in the mountain districts of Wales, Cumberland, and the Scottish Highlands. An absolute drought was experienced during the latter part of the month at many widely distributed stations. It was most marked in the Thames Valley where no rain fell after the 11th except at a few stations where the drought was broken by slight precipitation on the 25th. Ireland was generally rather wet and nearly twice the average fell at Glanmire (Co. Cork). The amounts varied from rather less than 2 inches in the north and east to more than 8 inches at exposed stations in Co. Mayo. The general rainfall expressed as a percentage of the average was :—England and Wales, 41; Scotland, 41; Ireland, 120; British Isles, 62.

In London (Camden Square) it was both the third driest and the third warmest May in 62 years' record. Mean temperature 58°·5 or 4°·5 above the average. Duration of sunshine 217·9 hours, and of rainfall 5·6 hours. Evaporation 2·94 inches.

RAINFALL TABLE FOR MAY, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875–1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	1·75	·33	—1·42	19	·18	2	4
Tenterden	*Kent*	1·65	·46	—1·19	28	·22	25	6
Arundel (Patching)	*Sussex*	1·80	·30	—1·50	17	·10	11	6
Fordingbridge (Oaklands)	*Hampshire*	2·09	·68	—1·41	33	·27	6	9
Oxford (Magdalen College)	*Oxfordshire*	1·81	·40	—1·41	22	·30	6	4
Wellingborough (Swanspool)	*Northampn*	1·98	1·22	— ·76	62	·96	6	6
Bury St. Edmunds (Westley)	*Suffolk*	1·93	·37	—1·56	19	·14	1	5
Geldeston [Beccles]	*Norfolk*	1·78	·69	—1·09	39	·30	7	7
Polapit Tamar [Launceston]	*Devon*	2·08	1·67	— ·41	80	·63	14	13
Rousdon [Lyme Regis]	,,	2·02	·98	—1·04	49	·28	14	8
Ross (Birchlea)	*Herefordshr.*	2·10	·33	—1·77	16	·11	5	8
Church Stretton (Wolstaston)	*Shropshire*	2·64	1·30	—1·34	49	·84	15	6
Boston	*Lincoln*	1·80	·67	—1·13	37	·22	24	6
Worksop (Hodsock Priory)	*Nottingham*	2·08	1·07	—1·01	51	·45	6	8
Mickleover Manor	*Derbyshire*	2·10	1·21	— ·89	58	·31	6	8
Congleton (Buglawton Vic.)	*Cheshire*	2·33	1·09	—1·24	47	·43	6	10
Southport (Hesketh Park)	*Lancashire*	2·13	1·10	—1·03	52	·52	24	8
Wetherby (Ribston Hall)	*York, W.R.*	2·09	1·09	—1·00	52	·27	1	10
Hull (Pearson Park)	,, *E.R.*	1·98	·84	—1·14	42	·30	1	7
Newcastle (Town Moor)	*North'land*	2·04	·92	—1·12	45	·20	8	11
Borrowdale (Seathwaite)	*Cumberland*	7·50	2·17	—5·33	29	...	...	...
Cardiff (Ely)	*Glamorgan*	2·56	·89	—1·67	35	·19	3	11
Haverfordwest	*Pembroke*	2·62	1·47	—1·15	56	·45	11	13
Aberystwyth (Gogerddan)	*Cardigan*	2·63	1·30	—1·33	49	·54	24	11
Llandudno	*Carnarvon*	1·86	1·09	— ·77	59	·38	15	9
Cargen [Dumfries]	*Kirkcudbrt.*	2·87	1·00	—1·87	35	·26	10	11
Marchmont House	*Berwick*	2·53	1·53	—1·00	60	·59	11	8
Girvan (Pinmore)	*Ayr*	2·98	1·10	—1·88	37	·31	2	13
Glasgow (Queen's Park)	*Renfrew*	2·40	·51	—1·89	21	·10	3, 4	7
Islay (Eallabus)	*Argyll*	2·58	1·53	—1·05	59	·38	20	9
Mull (Quinish)	,,	2·99	2·22	— ·77	74	·47	23	16
Loch Dhu	*Perth*	4·59	2·00	—2·59	44	·45	4	13
Dundee (Eastern Necropolis)	*Forfar*	2·05	1·01	—1·04	49	·43	6	12
Braemar	*Aberdeen*	2·33	1·65	— ·68	71	·60	30	8
Aberdeen (Cranford)	,,	2·40	·53	—1·87	22	·24	25	5
Gordon Castle	*Moray*	2·10	·28	—1·82	13	...	...	...
Drumnadrochit	*Inverness*	2·33	·54	—1·79	23	·16	11	7
Fort William	,,	3·93	1·39	—2·54	35	·36	11	13
Loch Torridon (Bendamph)	*Ross*	4·54	1·52	—3·02	34	·35	2	10
Dunrobin Castle	*Sutherland*	2·19	·50	—1·69	23	·45	11	2
Glanmire (Lota Lodge)	*Cork*	2·54	5·00	+2·46	197	2·02	13	9
Killarney (District Asylum)	*Kerry*	3·05	3·54	+ ·49	116	·70	14	20
Waterford (Brook Lodge)	*Waterford*	2·33	3·82	+1·49	164	1·18	14	14
Nenagh (Castle Lough)	*Tipperary*	2·51	3·92	+1·41	156	1·49	13	18
Ennistymon House	*Clare*	2·70	3·32	+ ·62	123	·88	14	17
Gorey (Courtown House)	*Wexford*	2·24	1·82	— ·42	81	·82	20	14
Abbey Leix (Blandsfort)	*Queen's Co.*	2·43	2·88	+ ·45	118	·75	14	14
Dublin (Fitz William Square)	*Dublin*	2·07	1·65	— ·42	80	·48	14	13
Mullingar (Belvedere)	*Westmeath*	2·51	2·23	— ·28	89	·45	20	11
Crossmolina (Enniscoe)	*Mayo*	3·17	3·50	+ ·33	111	·55	1	22
Cong (The Glebe)	,,	2·94	..	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	2·80	4·01	+1·21	143	·83	14	18
Seaforde	*Down*	2·72	4·27	+1·55	157	1·42	11	13
Ballymena (Harryville)	*Antrim*	2·84	2·20	— ·64	77	·42	13	13
Omagh (Edenfel)	*Tyrone*	2·66	1·84	— ·82	69	·29	1	18

SUPPLEMENTARY RAINFALL, MAY, 1919.

Div.	STATION.	Rain inches.
II.	Sevenoaks, Speldhurst Close.	·08
,,	Ramsgate	·23
,,	Hailsham	·22
,,	Totland Bay, Aston House...	·46
,,	Stockbridge, Ashley	·47
,,	Grayshott	·41
,,	Upton Nervet	·27
III.	Harrow Weald, Hill House...	·52
,,	Pitsford, Sedgebrook	·93
,,	Woburn, Milton Bryant	·70
,,	Chatteris, The Priory	·58
IV.	Elsenham, Gaunts End	·32
,,	Rayleigh	·36
,,	Colchester, Hill Ho., Lexden	·65
,,	Aylsham, Rippon Hall	·81
,,	Swaffham	·44
V.	Bishops Cannings	·82
,,	Weymouth	·81
,,	Ashburton, Druid House	1·60
,,	Cullompton	·81
,,	Lynmouth, Rock House	·84
,,	Okehampton, Oaklands	...
,,	Hartland Abbey	1·29
,,	St. Austell, Trevarna	2·05
,,	North Cadbury Rectory	·68
VI.	Clifton, Stoke Bishop	·34
,,	Ledbury, Underdown	·62
,,	Shifnal, Hatton Grange	·73
,,	Droitwich	·67
,,	Blockley, Upton Wold	·81
VII.	Grantham, Saltersford	1·99
,,	Louth, Westgate	·57
,,	Bawtry, Hesley Hall	·82
,,	Derby, Midland Railway	1·36
VIII.	Nantwich, Dorfold Hall	·69
,,	Bolton, Queen's Park	1·83
,,	Lancaster, Strathspey	1·63
IX.	Langsett Moor, Up. Midhope	1·67
,,	West Witton	1·59
,,	Scarborough, Scalby	1·33
,,	Ingleby Greenhow	·90
,,	Mickleton	·75
X.	Bellingham, High Green Manor	1·61
,,	Ilderton, Lilburn Cottage	·52
,,	Keswick, The Bank	2·99
,,	Orton	1·88
XI.	Llanfrechfa Grange	·34
,,	Treherbert, Tyn-y-waun	2·34
,,	Carmarthen, The Friary	1·49
,,	Fishguard, Goodwick Station.	1·36
,,	Crickhowell, Tal-y-maes	1·10
,,	Birmingham WW., Tyrmynydd	·72
,,	Lake Vyrnwy	1·38
,,	Llangynhafal, Plas Drâw	1·36
,,	Rhiwbryfdir	3·06
,,	Dolgelly, Bryntirion	1·56
XI.	Lligwy	1·04
,,	Douglas, Isle of Man	2·28
XII.	Stoneykirk, Ardwell House	1·46
,,	Carsphairn, Shiel	1·44
,,	Langholm, Drove Road	1·65
XIII.	Selkirk, The Hangingshaw	1·59
,,	North Berwick Reservoir	·65
,,	Edinburgh, Royal Observaty.	·66
XIV.	Biggar	·79
,,	Maybole, Knockdon Farm	·34
XV.	Shiskine	1·47
,,	Ardgour House	2·02
,,	Oban	1·39
,,	Holy Loch, Ardnadam	1·86
,,	Loch Venachar	1·60
XVI.	Glenquey	1·50
,,	Loch Rannoch, Dall	1·40
,,	Blair Atholl	...
,,	Coupar Angus	1·25
,,	Montrose, Sunnyside Asylum.	·70
XVII.	Balmoral	1·34
,,	Fyvie Castle	·47
,,	Keith Station	·39
XVIII.	Rothiemurchus	...
,,	Loch Quoich, Loan	3·60
,,	Skye, Dunvegan	2·68
,,	Fortrose	·35
,,	Glencarron Lodge	1·38
XIX.	Tongue Manse	·87
,,	Melvich	·31
,,	Loch More, Achfary	1·37
XX.	Dunmanway, The Rectory	4·60
,,	Mitchelstown Castle	4·68
,,	Gearahameen	6·50
,,	Darrynane Abbey	3·64
,,	Clonmel, Bruce Villa	4·06
,,	Roscrea, Timoney Park	3·51
,,	Broadford, Hurdlestown	3·12
XXI.	Enniscorthy, Ballyhyland	2·81
,,	Rathnew, Clonmannon	1·88
,,	Hacketstown Rectory	2·54
,,	Ballycumber, Moorock Lodge	2·83
,,	Balbriggan, Ardgillan	1·51
,,	Castle Forbes Gardens	3·47
XXII.	Ballynahinch Castle	3·84
,,	Woodlawn	3·54
,,	Westport House	3·29
,,	Dugort, Slievemore Hotel	5·86
XXIII.	Enniskillen, Portora	3·26
,,	Dartrey [Cootehill]	3·16
,,	Warrenpoint, Manor House	2·17
,,	Belfast, Cave Hill Road	1·52
,,	Glenarm Castle	...
,,	Londonderry, Creggan Res.	1·36
,,	Milford Manse	1·67
,,	Killybegs	3·34

Climatological Table for the British Empire, December, 1918.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	58·6	3	26·9	26	50·5	41·0	43·8	92	79·7	20·3	2·34	24	7·8
Malta	66·6	10	48·0	2	61·1	53·1	...	85	117·0	43·0	3·69	14	2·3
Lagos	90·3	9	70·0	21	88·0	74·3	21·1	71	154·3	60·3	·02	1	7·8
Cape Town	89·7	31	53·7	27	76·8	59·1	54·7	64	...	...	·86	7	3·8
Johannesburg	85·2	16	47·4	1	75·6	55·5	53·8	74	...	48·8	7·56	13	6·5
Mauritius	91·2	20	64·0	17	87·0	70·0	66·0	67	...	56·5	·82	8	4·4
Bloemfontein	97·1	18	47·3	20	85·6	57·3	52·2	49	..	...	1·35	7	4·8
Calcutta...	81·2	13	49·7	21*	77·0	55·2	52·2	64	...	39·9	·49	2	1·8
Madras	86·0	16	67·3	30	83·1	72·0	69·5	80	156·7	63·5	6·67	8	5·3
Colombo, Ceylon ...	89·1	20	68·2	29	86·1	72·6	71·2	80	160·8	63·6	4·45	17	7·0
Hongkong	78·6	20	49·2	28	68·9	62·4	59·7	80	...	...	·14	4	8·2
Sydney	101·0	20	53·8	1	79·8	62·0	56·0	59	161·0	39·8	·89	7	4·0
Melbourne	...	...	...	...	...	...	...	...	...	...	...	...	...
Adelaide	107·8	9	46·4	21	84·2	58·5	49·6	42	165·0	37·2	·62	5	3·2
Perth	100·7	31	54·4	3	81·2	59·9	57·0	64	159·8	47·3	·24	5	2·5
Coolgardie	107·2	5, 7	49·5	13	93·0	60·6	46·4	28	175·2	48·0	·11	2	1·6
Brisbane	101·1	3	57·9	1	85·1	67·8	63·3	66	157·2	53·4	·88	7	4·7
Hobart, Tasmania ..	91·3	23	43·0	21	69·1	51·7	44·8	53	157·0	37·2	1·81	14	6·9
Wellington ...	74·6	17	42·9	14	63·9	51·4	48·2	72	149·0	30·0	2·73	11	5·3
Jamaica, Kingston ..	91·4	10	66·6	27	87·5	70·3	68·0	79	...	...	·57	10	4·1
Grenada	86·0	31	71·0	Sev.	83·0	74·0	...	77	137·0	...	4·39	16	4·5
Toronto	50·8	14	13·7	1	37·2	25·4	26·7	86	104·4	4·8	3·30	13	7·3
Fredericton	49·0	23	− 5·5	8	28·0	12·9	15·2	83	...	...	2·26	12	6·0
St. John, N.B. ...	47·4	15	3·0	31	31·2	19·1	22·0	79	99·2	1·5	3·11	14	6·3
Victoria, B.C.	51·2	14	30·2	31	44·6	37·1	38·0	88	98·0	23·5	7·15	17	7·0

*and 26.

Johannesburg.—Bright sunshine 242·1 hours.

Bloomfontein.—Total R for the year 24·18 in., falling on 73 days.

COLOMBO, CEYLON.—Mean temp. 79°·4, or 0°·5 above, dew point 0°·2 above, and R ·15 in. above, averages. Mean hourly velocity of wind 4·4 miles. T88 on 5 days. Prevailing direction of wind was north.

HONGKONG.—Mean temp. 65°·2. Bright sunshine 108·9 hours. Mean hourly velocity of wind 13·6 miles.

Adelaide.—Mean temp. 0°·2 above, and R ·34 in. below, averages.

Perth.—R ·34 in. below average.

Coolgardie.—Temp. 1°·0 above, and R about ·50 in. below, averages.

Brisbane.—Temp. 0°·2 below, and R 4·07 in. below, averages.

Wellington.—Mean temp. 2°·7 below, and R ·56 in. below, averages. Bright sunshine, 219·9 hours. Frost on 2 mornings. T8 on night of 30th.

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ITALIAN CLOUD ATLAS.*

By L. C. W. Bonacina.

The beauty of the clouds in regard to form, colour and grouping is of a high order, and has been extensively portrayed in writing, painting and photography. Until the last few years, however, our scientific knowledge of them was rather meagre, and this for the very good reason that we had practically no means of reaching the shifting masses of condensed or frozen vapour that form in the free air. The rapid development of aviation which the war stimulated has, however, resulted in the acquisition of valuable knowledge regarding the various kinds of cloud and the process of condensation; and in this connection I would particularly draw attention to the valuable flying observations of Lieut. C. K. M. Douglas, who has shown, for example, that the dazzling white summits of cumulo-nimbus or thunder clouds are not frozen but consist of super-cooled droplets until the false cirrus stage arrives when the whole mass turns bodily into snow. But apart from such purely scientific ends it is clear that the aeronaut has much practical concern with all that appertains to cloud formation. An airman might not, indeed, contemplate a massive thunder pile with the same dread with which the navigator would an iceberg; but he, nevertheless, finds it advisable to avoid formations of that character for not only are such clouds highly charged with electricity, but constituting the visible heads of powerful ascending currents they indicate the seat of violent turbulence with sudden changes of wind velocity. Modern engineering, in fact, has imparted an enhanced realism to the region of the clouds with the inevitable result that every new work on clouds, as on meteorology is general, is sure to attract more

*R. Ufficio, Centrale di Meteorologia e Geodinamica, Roma. Luigi Taffara. Le Nubi. Parte I.: Testo. Parte II.: Atlante. Rome, 1917. Size 10 × 14, pp. 67, pl. xxvi. *Illustrations in text.*

notice than was formerly the case. Hence it becomes an added pleasure to draw the attention of readers to the handsome cloud atlas which has been complied by the Italian Meteorological Office. The reproductions from photographs in this collection are good, on the whole decidedly more impressive than those in the International Cloud Atlas (1910) or the Belgian Atlas (1907), upon which the Italian atlas, in regard to the system of cloud nomenclature used, is modelled. There is a good example of those exquisitely delicate fleecy flakes of upper cloud which we in England are accustomed to call Cirro-Cumulus rather than Alto-Cumulus, but is here designated Alto-Cumulus Granosus in accordance with the peculiar system of nomenclature adopted—an illustration, surely, of the folly of detailed cloud classification. Very striking, indeed, are two photographs of the lower cumuloform thunder clouds taken in Rome on July 31st, 1913, and named Cumulus Compositus. One may study the clouds as physical phenomena, on the one hand, which relegates them to the domain of pure meteorology; or as expressions of climate, on the other hand, which immediately connects them with geography. In the present atlas the climatic aspect of the subject is happily not overlooked inasmuch as the place and date of occurence are given for each of the cloud specimens illustrated in the twenty-six plates, which refer mainly to Rome, Paris and Catania, in Sicily, but represent a few other places as well. The International Atlas, on the other hand, has the serious defect of affording no indication whatever of times and places, which means that as a *climatological* study and as a contribution to geography, whose distinctive function is to treat of what concerns *regions*, it is quite a failure. So inadequate, however, is the geographical representation in the Italian work that it would have been, climatically speaking, more consistent if the author had confined his collection solely to clouds seen in Italy, just as the Belgian atlas comprises only Belgian clouds, and as a cheap little atlas recently published by our own Meteorological Office exhibits only clouds observed at Aberdeen. In this connection I would observe that it would be a valuable contribution to climatology and meteorology alike were each country to bring out from time to time a pictorial selection of its own cloud occurrences. Although the several cloud types in their broad outlines are common to the whole world it is equally true that in their minor features the clouds are closely dependent upon geographical conditions, and it is accordingly a great pity that this most interesting question has received so little systematic study. There is a passage in Ruskin's "Modern Painters" (Vol. V., ch. 3) to the effect that "the true high cirri never cross a mountain in Europe" and that "the true cumulus is never seen in a great mountain region, at least in association with hills" being "always broken up and modified by them." If Ruskin's observation is substantially correct, and his generalization would certainly seem to have the support of

theory, in maintaining that the high mountains are unfavourable to the genesis of those compact storm ranges of infinite grandeur so often seen in the plains, I would particularly emphasize this: that it is a wise dispensation which accords to dwellers in the more monotonous plains occasional glimpses of accumulations of clouds which is their type-form are strongly suggestive of mountain systems.

I have often noticed when at the sea-side how decidedly the marine cumulus which tends to develop at night or in the early morning differs in complexion and texture from the more clear-cut hard-edged land cumulus which forms by day or late in the afternoon. Along the English coasts both kinds may in certain phases of summer weather be seen to perfection, the morning form out at sea and the evening variety inland. I think I may safely attribute this difference between the sea-born and the land-born varieties of cumulus to differences in the character of that convectional driving power which is the source of every true cumulus: for it must be remembered that while day convection over the land is associated with the effects of surface heating the somewhat less vigorous action at a lower general level of temperature which takes place by night over the sea is connected with the fact that out at sea the diurnal range of temperature in the higher atmospheric levels at about 4,000 feet is much greater than that in the air close to the surface of the water.

The text in the Italian work will be of great utility to those who may take up practical cloud observations though it may possibly strike some as too technical to be a suitable accompaniment to a series of pictures for whose publication the apology is evidently the artistic skill displayed; it discusses cloud photography and nomenclature and describes various kinds of nephoscope for observing with precision the motion of clouds. Mention may be made of an apparatus devised by the compilor of the atles which combines the function of photographic camera, theodolite, and nephoscope so that the height and motion of the cloud photographed can be obtained. The system of nomenclature which is that used in the Belgian atlas, though apparently appreciated in France, is little known in England, and in any case is much too detailed to be of real utility. It is thoroughly inexpedient to attempt to classify clouds closely or to go beyond the primary division into such fundamental forms as *Cirrus*, *Stratus*, and *Cumulus*, or such definite intermediate forms as Cirro-Cumulus, Cirro-Stratus, Alto-Cumulus, and Alto-Stratus. The International Meteorological Committee fixed upon ten typical names and it is not wise to adopt any more for fear of confusion. The clouds, indeed, are much better described than classified.

It might be added that there are no fine descriptive passages in the Italian text, and in the absence of anything in the nature of word-painting the clouds as objects of beauty are left to speak for themselves.

Correspondence.

To the Editor of Symons's Meteorological Magazine

UNUSUAL HAIL STORM.

On June 12th, 1919, a startling hail storm was experienced six miles to the south from Branxholme. This storm passed north-west in a belt well within two miles in width. At Carlanrig Farm house, 757 feet above sea, at the head of the Teviot river, and situated in the centre of this belt, the hail storm appears to have been at its worst and not much trace of it can be got further south. It commenced about 3.30 p.m., and lasted violently for about five minutes. There was at the time a warm gusty wind from the south, and the hail came with considerable force. The stones were not all shaped alike; but mostly nearly round, of the size of marbles or pigeon's eggs, icy hard, and clear.

Though rounded they cut the stems of plants, and were painful to people. A man who was outside during most of the storm, and who was wearing a cloth cap, had bumps and swellings all over the surface of his head caused by the hail. Cattle got quite distracted, and could not be gathered together. In the farm house about fifty panes of glass were broken. Leaves and twigs were stripped off trees, and garden crops severely damaged.

At Teviothead, shortly after 2 p.m., there was hail for a few minutes, then a lull, and then the blinding shower after 3 p.m. This last covered the ground to the depth of three to four inches. The whole lasted about half an hour. The darkness at this time could almost "be felt." For three miles at least going north-west from Carlanrig, there is the same story of broken glass and damaged gardens. At Teviothead some of the hailstones seemed to have sharp pieces of ice protruding from the ball. A few taken at random and measured were found to be from two to three inches in circumference.

There are reports of hail falling to the north and westward, a dozen of so miles from Teviothead, but apparently ordinary showers not causing damage. JOHN G. WINNING.

Branxholme, 19th June, 1919.

There was very heavy rain in Ayrshire during a sovere thunderstorm on June 12th, 1919. I am told 4 inches fell in twelve hours at Knockdon Farm, Maybole. Other places in the district had 2·50 and 3 inches. We had the same thunderstorm here but only 1·02 in. of rain in four and a half hours. It was the worst thunderstorm in this district since August 12th, 1885. R M. KER

Boghall, Milngavie, Dunbartonshire, June 16th, 1919.

A SEVERE thunderstorm was experienced in this district on Thursday, 12th June, with an exceptional rainfall. The rainfall recorded at Kerse Filters, Patna, was 3·43 in. for the 24 hours ending 9 a.m. of the 13th. Rain came on about 10 a.m. on the 12th, and my gauge showed the fall from then till 6.30 p.m. to be 3 inches.

7, Wellington Square, Ayr, 14th June, 1919. WILLIAM GRAY.

A RAINFALL CONTRAST.

AFTER an excessive rainfall from January to the end of March, we have had a three months' dry spell, which has been more severe than any in my records. Up till June 20th, the drought seems to have been more severe in south-east England, as Atlantic depressions prevented from advancing over England by high pressure over the Nor h Sea, had given occasional slight rainfall to our western and northern coasts. On June 20th, a secondary to one of these gave copious rains to the south of England, about 1·25 in. being recorded in the London area. Our district was, however, too far north-west to be affected by it, only ·22 in. falling. I have never known the ground so dry and the outlook for potatoes and root crops is serious. Hereford, Salop, Monmouth, Radnor and Worcester (or parts of the same) seem to have suffered most. Below is given the fall from January 1st to June 30th, compared with the average :—

	Rainfall. in.	Excess. in.		Rainfall. in.	Deficit. in.
Jan. ..	3·84	1·36	.... April ..	1·40	·82
Feb. ..	4·25	1·45	.... May ..	·37	2·23
March ..	5·80	2·36	.... June ..	1·00	1·19
Total ..	13·89	5·17		2·77	4·24

In the hot summer of 1911, April, May and June produced as much as 5·37 in., and in 1896, they produced the small total of 3·36 in. Throughout the last three months there has been no absolute drought, rain falling on 8 days in May, and on 12 in June. When the ground is bone dry and sun scorched, rain seems to have no encouragement to fall. I am speaking here only of cyclonic rain. If a drought is broken it seems to require a thunder-plump to do it, unless the air turns cold and cannot hold the moisture so well. On the several occasions on which minute quantities of rain fell in May and June with west-south-west winds, I am convinced that had the ground been thoroughly wet each of these occasions would have produced respectable downpours, the rain required to be met half way so to speak, but failing this, the dark clouds passed over and in a few hours the sun resumed his sway. This is an interesting question which I have never seen discussed, though I am fully persuaded that it is not a theory but an actual fact. R. P. DANSEY.

Kentchurch Rectory, Hereford, July 1st, 1919.

THE SNOWSPOT ON CARNEDD LLEWELYN.

I ENCLOSE a photograph taken on June 3rd by my son of the snow-spot on Carnedd Llewelyn described by me in *British Rainfall 1909* (see pp. 46-53). The length of the bed of snow was forty-five yards, and the greatest width, 10 yards. It was still visible from a distance on June 15th and appeared likely to last till the end of the month.

Considering the full sunshine which the snow actually faced for SIX weeks, it is a wonder that it lasted so long. The drifts above 2,500 feet on the Snowdonian range were, however, exceptionally large this year. J. R. GETHIN-JONES.

Bryn Awel, St. Mary's Road, Llandudno, June 21st, 1919.

METEOROLOGICAL NEWS AND NOTES.

MR. CARLE SALTER has been awarded the President's premium of the Institution of Water Engineers, for his paper on "The Relation of Rainfall to Configuration," read at the meeting on December 18th, 1918.

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION at the Central Hall, Westminster, illustrates the great part played by modern science in the prosecution of the war. Lectures on special aspects of the applications of Science to Industry are given at intervals, and a series of kinematograph films of scientific and technical interest is shown on other dates. The latter includes films illustrating "The Water Powers of Canada and their Industrial Utilization."

MR. C. T. R. WILSON has been appointed Reader in Electrical Meteorology at Cambridge University.

ROYAL METEOROLOGICAL SOCIETY.

A MEETING was held on June 18th, at 70, Victoria Street, S.W., Sir Napier Shaw, F.R.S., President, in the Chair.

A paper by Col. Sir Charles Close, K.B.E., F.R.S., entitled, "Note on the Rainfall at Southampton and London during a period of fifty-seven years (1862-1918)" was read. The form in which statistics are usually published does not readily lend itself to a clear appreciation of the existence of a simple seasonal period. If, after correcting for monthly inequalities, the accumulation of rainfall, reckoning from any fixed date, is tabulated and plotted, the rainfall assumes a more regular aspect. If further, from these monthly figures of accumulation, is deducted the average precipitation, the remaining figures approximate to a simple sine curve, with an annual period. The irregularities left over occur chiefly in September and October.

It would appear that at the places in question the rainfall can be considered to result from uniform precipitation throughout the year, modified by a simple annual harmonic term, further modified by small irregularities in September and October.

A discussion followed in which Mr. Carle Salter showed that an examination of average monthly values at many widely distributed stations exhibited a similar characteristic to that shown by Sir Charles Close. Mr. Giblett stated the results of a harmonic analysis of several records. Mr. J. E. Clark spoke of the effect of thunderstorms on average values for the summer months. Mr. H. E. Carter exhibited the results of hourly duration and amount of rainfall treated as Sir Charles Close had treated monthly values. Sir Napier Shaw spoke of the deviations of monthly values resulting from want of uniformity in the length of the months.

A "Note on Tornadoes," by Lieut. J. Logie, R.A.F., aimed at showing that no convection currents are capable of producing tornadoes of the intensity claimed for some of these storms. The author computed the difference of temperature between the air in the centre of the tornado and that outside. For a tornado having a pressure reduction of 50 millibars at the surface the mean temperature difference was found to be 23°A if the tornado extended to 5 kilometres (16,000 feet), 10°A if it extended to 10k., and 5°A if it extended to 15k. From the known values of the lapse-rate of saturated air it follows that under conditions of maximum instability a saturated ascending current not less than 8k. high might produce a tornado of this intensity. Since such instability rarely occurs, and in addition ascending currents of saturated air are usually everywhere penetrated by descending masses of cooler air, even a tornado of this intensity is unlikely to be so produced in natural conditions. It was suggested that the required rise of temperature may be due to lightning which is usually described as a characteristic of the funnel-cloud.

Lt.-Col. E. Gold quoted Mr. C. T. R. Wilson's results to refute the suggestion that lightning flashes are instrumental in causing the rise in temperature. Lieut. J. S. Turner, Mr. J. S. Dines, Mr. E. C. Barton and Sir Napier Shaw also contributed to the discussion.

A paper by Capt. D. Brunt, R.E., was entitled, "A Periodogram Analysis of the Greenwich Temperature Records." The monthly mean temperatures at Greenwich for the years 1841 to 1890 were represented by a Fourier Series up to 100 terms, to permit of the detection of any periods of length greater than one year. Periods of 9·5, 5 and 4 years, 28 months, and 20 months, were shown to exist, all having amplitudes of the order of 0°·5 F. Many of the periods found were not continuous, *e.g.*, the 20-month period died away about 1894, being replaced by a period of about 28 months. The general result showed that periods in astronomical sense do not exist in these temperature records. The result of correcting the observations for the effect of the periods found produced an almost inappreciable diminution of the standard deviation of the observations, tending to show that variations of the monthly mean temperatures from year to year may be regarded as purely chance variations or as due to periods of length less than a year.

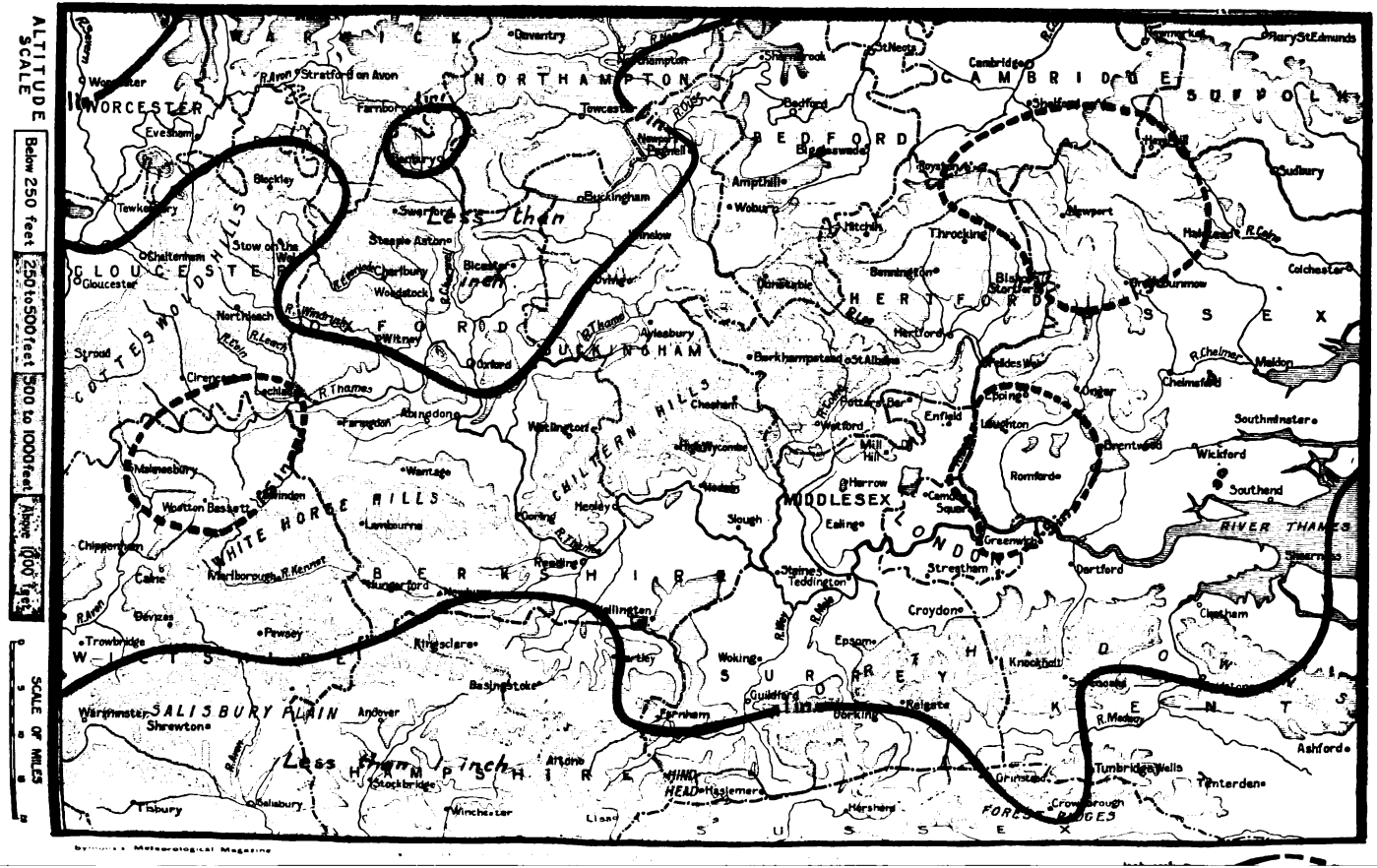
Mr. J. I. Craig, of the Egyptian Survey Dept., said he had found the existence of the nine-year and five-year periods in an investigation of the maximum annual height of the Nile during the past eight hundred years. Mr. C. E. P. Brooks, Mr. F. J. W. Whipple and Mr. W. W. Bryant also spoke.

Lt.-Col. E. Gold presented a summary of a paper by Lieut. E. Green, R.E., "on the Propagation of Sound in the Atmosphere." It contained a theoretical discussion in connection with experimental observations of the velocity of sound under normal atmospheric conditions as regards temperature and wind velocity. Numerical results were added for some interesting cases.

The following candidates were elected Fellows of the Society :— Mr. R. Brenard, Capt. J. Durward, R.E., Capt. C. Frobisher, R.A.F., Dr. W. Gordon, M.A., F.R.C.P., Major R. M. Ker, and Mr. T. Phillips.

A summer meeting of the Society was held on July 2nd, when a large company of Fellows and friends attended the Kew Observatory, Richmond. Mr. R. A. Watson-Watt, gave a demonstration of a portable wireless apparatus for use in the location of distant lightning flashes. Pilot balloon ascents were carried out from the Observatory grounds and Sir Napier Shaw exhibited two diagrams showing the motion of air in travelling depressions. A special exhibition of photographs of clouds and other meteorological phenomena added to the interest of the meeting.

THAMES VALLEY RAINFALL, JUNE, 1919.



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THE WEATHER OF JUNE.

UNTIL about the 18th, the type of pressure distribution over the major part of the United Kingdon was anti-cyclonic, and the weather was therefore mainly fair and very dry. One or two important exceptions were, however, observed. Thunderstorms occurred in many places on the 1st, and on the two succeeding days, when the prevailing winds were from N. or N.W., the weather was decidedly cool. Ground frost was observed in several districts on the night of the 2nd, the exposed thermometer falling to a minimum of 24° at Greenwich and Rhayader, and to 25° at Wisley. Next day shade maxima below 60° were recorded at a number of stations in the north and east of England; at Cromer and Norwich the thermometer did not rise much above 50°. Another marked exception to the general run of fair weather occurred on the 12th, when Ireland and the west of Scotland were visited by severe thunderstorms and extremely heavy falls of rain, amounting to between 2 and 2½ inches in many places. (*See* letters on pp. 64 and 65 ante). In Ireland and Scotland the thermometer never reached a high summer level, but over a large portion of England shade maxima of 80° and upwards were recorded on at least three occasions, viz.: about the 7th, the 11th and the 16th, the reading at Camden Square (in the Glaisher screen), on the 11th being as high as 85°. In the rear of a depression which passed eastward across Ireland and England between the 11th and 13th, a cold northerly wind sprang up, and on the last mentioned date the thermometer in many places failed to reach 60°; while on the following night a slight ground frost was observed in isolated parts of England and Wales.

Between the 19th and 20th the development of a shallow depression over southern England was attended by copious and very welcome falls of rain in the Home counties; and for the remainder of the month when the prevailing winds were from between north and west the weather was cool, cloudy and rather changeable, though mostly dry. During the closing week there were at least two or three occasions upon which the thermometer over a large portion of the country failed to reach 60°. At some places on the 26th it did not touch 55°, and at night a sharp ground frost was again experienced locally, the exposed thermometer falling to 24° at Greenwich, 26° at Wisley, and 28° at Raunds and Tunbridge Wells.

In most of the western and northern districts the total duration of bright sunshine was below the average, but over the greater part of England, where the second week was extremely fine, there was a general, though not very large, excess.

The total rainfall was generally deficient over England but exceeded the average over a small area in Wales, the whole of the west of Scotland, and all but the southern counties of Ireland. Large areas in the south of England and the Midlands had a total fall under one inch, and practically the whole of England, excluding Wales and the Lake District, had less than 2 inches. A large area in Wales had more than 5 inches, and nearly 1 inches fell on Plinlimon. In Scotland the total ranged from about an inc in the extreme north-east to more than 10 inches west of the Caledonian Canal and nearly 20 inches at Loan. In Ireland, only a small area in Co. Cork had less than an inch, and 4 inches was exceeded at many inland and west coast stations. The general rainfall expressed as a percentage of the average was:—England and Wales, 62; Scotland, 139; Ireland, 105; British Isles, 96.

In London (Camden Sqnare) the partial drought, which had lasted for seven weeks, broke up on the 19th and thereafter the weather was cool and showery. Duration of sunshine 214·3 hours, and of rainfall 27·3 hours. Evaporation 3·39 inches

RAINFALL TABLE FOR JUNE, 1919.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875–1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·28	1·51	— ·77	66	·85	20	9
Tenterden	*Kent*	2·03	·47	—1·56	23	·39	20	4
Arundel (Patching)	*Sussex*	2·13	·79	—1·34	37	·60	20	5
Fordingbridge (Oaklands)	*Hampshire*	1·93	·92	—1·01	48	·36	20	7
Oxford (Magdalen College)	*Oxfordshire*	2·27	·89	—1·38	39	·24	12	9
Wellingborough (Swanspool)	*Northampn*	2·14	·74	—1·40	35	·29	21	5
Bury St. Edmunds (Westley)	*Suffolk*	2·21	1·26	— ·95	57	·42	20	10
Geldeston [Beccles]	*Norfolk*	1·77	1·26	— ·51	71	·44	20	11
Polapit Tamar [Launceston]	*Devon*	2·18	1·06	—1·12	49	·35	24	10
Rousdon [Lyme Regis]	,,	2·18	·68	—1·50	31	·30	20	6
Ross (Birchlea)	*Herefordshr.*	2·43	1·08	—1·35	44	·43	12	12
Church Stretton (Wolstaston)	*Shropshire*	2·59	1·04	—1·55	40	·47	13	8
Boston	*Lincoln*	1·95	·91	—1·04	47	·23	30	12
Worksop (Hodsock Priory)	*Nottingham*	2·06	·92	—1·14	45	·20	21	16
Mickleover Manor	*Derbyshire*	2·55	1·00	—1·55	39	·36	12	12
Congleton (Buglawton Vic.)	*Cheshire*	2·69	2·36	— ·33	88	·55	12	17
Southport (Hesketh Park)	*Lancashire*	2·26	1·35	— ·91	60	·31	19	13
Wetherby (Ribston Hall)	*York, W.R.*	2·17	·86	—1·31	40	·20	24	10
Hull (Pearson Park)	,, *E.R.*	2·09	·68	—1·41	33	·15	30	13
Newcastle (Town Moor)	*North'land*	2·04	1·48	— ·56	73	·42	22	16
Borrowdale (Seathwaite)	*Cumberland*	6·94	5·86	—1·08	84	...	...	...
Cardiff (Ely)	*Glamorgan*	2·55	1·42	—1·13	56	·67	12	15
Haverfordwest	*Pembroke*	2·74	2·53	— ·21	92	1·16	12	13
Aberystwyth (Gogerddan)	*Cardigan*	2·97	5·02	+2·05	169	2·95	12	15
Llandudno	*Carnarvon*	1·97	1·52	— ·45	77	·39	12	16
Cargen [Dumfries]	*Kirkcudbrt.*	2·84	1·93	— ·91	68	·52	19	16
Marchmont House	*Berwick*	2·38	1·54	— ·84	65	·28	3	13
Girvan (Pinmore)	*Ayr*	3·04	4·37	+1·33	144	2·45	13	16
Glasgow (Queen's Park)	*Renfrew*	2·41	3·48	+1·07	145	1·47	12	18
Islay (Eallabus)	*Argyll*	2·80	5·40	+2·60	193	·84	15	23
Mull (Quinish)	,,	3·30	6·42	+3·12	194	1·15	7	25
Loch Dhu	*Perth*	4·45	4·25	— ·20	96	·80	16	14
Dundee (Eastern Necropolis)	*Forfar*	2·06	1·56	— ·50	76	·26	24	16
Braemar	*Aberdeen*	2·18	1·94	— ·24	89	·50	29	19
Aberdeen (Cranford)	,,	2·02	1·16	— ·86	57	·18	29	18
Gordon Castle	*Moray*	2·13	2·70	+ ·57	127	...	...	...
Drumnadrochit	*Inverness*	2·26	3·11	+ ·85	138	·75	28	22
Fort William	,,	3·77	6·60	+2·83	175	1·27	15	25
Loch Torridon (Bendamph)	*Ross*	4·07	11·79	+7·72	290	1·72	15	23
Dunrobin Castle	*Sutherland*	2·10	1·78	— ·32	85	·33	10	11
Glanmire (Lota Lodge)	*Cork*	2·91	·79	—2·12	27	·19	10, 11	11
Killarney (District Asylum)	*Kerry*	2·92	1·38	—1·54	47	·24	11	18
Waterford (Brook Lodge)	*Waterford*	2·79	1·82	— ·97	65	·66	12	9
Nenagh (Castle Lough)	*Tipperary*	2·70	2·31	— ·39	86	·59	11	16
Ennistymon House	*Clare*	3·18	2·81	— ·37	88	·69	11	20
Gorey (Courtown House)	*Wexford*	2·59	1·58	—1·01	61	·78	12	10
Abbey Leix (Blandsfort)	*Queen's Co.*	2·58	4·48	+1·90	173	2·08	12	16
Dublin (Fitz William Square)	*Dublin*	2·00	3·12	+1·12	156	1·81	12	14
Mullingar (Belvedere)	*Westmeath*	2·72	3·88	+1·16	143	2·18	12	11
Crossmolina (Enniscoe)	*Mayo*	3·17	4·95	+1·78	156	·82	15	20
Cong (The Glebe)	,,	3·18	3·33	+ ·15	105	·57	18	16
Collooney (Markree Obsy.)	*Sligo*	3·11	4·07	+ ·96	131	·52	3	23
Seaforde	*Down*	2·88	3·03	+ ·15	105	1·48	12	16
Ballymena (Harryville)	*Antrim*	2·89	3·15	+ ·26	109	·43	10, 12	17
Omagh (Edenfel)	*Tyrone*	2·82	3·70	+ ·88	131	·57	11	19

SUPPLEMENTARY RAINFALL, JUNE, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches.
II.	Sevenoaks, Speldhurst Close.	1·03	XI.	Lligwy	1·62
,,	Ramsgate	·85	,,	Douglas, Isle of Man	...
,,	Hailsham	·48	XII.	Stoneykirk, Ardwell House	3·00
,,	Totland Bay, Aston House	·98	,,	Carsphairn, Shiel	7·04
,,	Stockbridge, Ashley	·93	,,	Langholm, Drove Road	2·43
,,	Grayshott	·83	XIII.	Selkirk, The Hangingshaw	1·53
,,	Upton Nervet	·99	,,	North Berwick Reservoir	1·87
III.	Harrow Weald, Hill House	1·36	,,	Edinburgh, Royal Observaty.	1·70
,,	Pitsford, Sedgebrook	·64	XIV.	Biggar	2·36
,,	Woburn, Milton Bryant	1·40	,,	Maybole, Knockdon Farm	5·92
,,	Chafteris, The Priory	1·15	XV.	Shiskine	3·80
IV.	Elsenham, Gaunts End	1·59	,,	Ardgour House	10·92
,,	Rayleigh	1·23	,,	Oban	6·80
,,	Colchester, Hill Ho., Lexden	1·15	,,	Holy Loch, Ardnadam	5·96
,,	Aylsham, Rippon Hall	1·51	,,	Loch Venachar	3·20
,,	Swaffham	1·48	XVI.	Glenquey	3·50
V.	Bishops Cannings	1·34	,,	Loch Rannoch, Dall	2·32
,,	Weymouth	·73	,,	Blair Atholl	...
,,	Ashburton, Druid House	·99	,,	Coupar Angus	1·83
,,	Cullompton	·89	,,	Montrose, Sunnyside Asylum.	·91
,,	Lynmouth, Rock House	1·36	XVII.	Balmoral	2·03
,,	Okehampton, Oaklands	...	,,	Fyvie Castle	2·65
,,	Hartland Abbey	1·28	,,	Keith Station	3·46
,,	St. Austell, Trevarna	·98	XVIII.	Rothiemurchus	3·85
,,	North Cadbury Rectory	1·41	,,	Loch Quoich, Loan	19·80
VI.	Clifton, Stoke Bishop	1·46	,,	Skye, Dunvegan	8·65
,,	Ledbury, Underdown	·95	,,	Fortrose	1·81
,,	Shifnal, Hatton Grange	1·29	,,	Glencarron Lodge	8·67
,,	Droitwich	1·20	XIX.	Tongue Manse	3·56
,,	Blockley, Upton Wold	1·18	,,	Melvich	3·19
VII.	Grantham, Saltersford	·85	,,	Loch More, Achfary	8·40
,,	Louth, Westgate	·64	XX.	Dunmanway, The Rectory	1·01
,,	Bawtry, Hesley Hall	·81	,,	Mitchelstown Castle	1·28
,,	Derby, Midland Railway	·77	,,	Gearahameen	3·20
VIII.	Nantwich, Dorfold Hall	1·88	,,	Darrynane Abbey	1·53
,,	Bolton, Queen's Park	1·29	,,	Clonmel, Bruce Villa	2·65
,,	Lancaster, Strathspey	1·97	,,	Roscrea, Timoney Park	3·97
IX.	Langsett Moor, Up. Midhope	·63	,,	Broadford, Hurdlestown	2·81
,,	West Witton	·85	XXI.	Enniscorthy, Ballyhyland	2·96
,,	Scarborough, Scalby	1·19	,,	Rathnew, Clonmannon	1·14
,,	Ingleby Greenhow	1·50	,,	Hacketstown Rectory	2·83
,,	Mickleton	·20?	,,	Ballycumber, Moorock Lodge	3·37
X.	Bellingham, High Green Manor	1·70	,,	Balbriggan, Ardgillan	2·55
,,	Ilderton, Lilburn Cottage	1·06	,,	Castle Forbes Gardens	2·62
,,	Keswick, The Bank	3·22	XXII.	Ballynahinch Castle	5·47
,,	Orton	2·44	,,	Woodlawn	2·66
XI.	Llanfrechfa Grange	·89	,,	Westport House	2·80
,,	Treherbert, Tyn-y-waun	3·73	,,	Dugort, Slievemore Hotel	6·51
,,	Carmarthen, The Friary	2·45	XXIII.	Enniskillen, Portora	3·16
,,	Fishguard, Goodwick Station.	2·72	,,	Dartrey [Cootehill]	4·43
,,	Crickhowell, Tal-y-maes	1·50	,,	Warrenpoint, Manor House	2·67
,,	Birmingham WW., Tyrmynydd	3·32	,,	Belfast, Cave Hill Road	2·36
,,	Lake Vyrnwy	...	,,	Glenarm Castle	2·94
,,	Llangynhafal, Plas Drâw	3·69	,,	Londonderry, Creggan Res.	3·81
,,	Rhiwbryfdir	6·52	,,	Milford Manse	3·66
,,	Dolgelly, Bryntirion	5·37	,,	Killybegs	4·27

Climatological Table for the British Empire, January, 1919.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	54·3	15	25·1	23	42·6	33·1	35·5	91	74·0	21·1	3·22	22	7·8
Malta	64·4	2, 3	40·0	21	59·3	50·9	...	90	112·0	41·0	3·59	18	7·5
Lagos	97·0	3	73·0	1	82·8	73·4	74·6	77	147·2	73·0	·12	3	7·3
Cape Town	87·1	19	53·0	9	78·2	59·6	55·3	62	...	...	·98	7	3·4
Johannesburg	84·5	15	50·9	19	76·6	57·4	57·2	80	...	52·8	4·78	17	6·0
Mauritius	94·8	15	68·5	2	89·9	73·3	71·1	74	...	65·2	5·76	16	6·3
Bloemfontein	92·8	12	51·3	29	87·3	59·6	56·4	57	...	...	2·87	10	3·7
Calcutta...	83·4	13	49·4	17	78·2	58·9	58·6	72	...	38·5	·58	1	4·6
Madras	87·4	30	64·5	2	85·3	72·1	70·0	78	155·6	61·2	·37	1	3·6
Colombo, Ceylon ...	91·8	16	65·9	12	88·0	73·0	71·1	77	162·6	58·1	4·33	12	5·0
Hongkong	78·4	10	46·8	3	65·4	58·6	...	81	...	...	·63	11	8·5
Sydney	97·9	21	58·8	18	80·1	65·5	60·4	63	152·0	51·9	1·55	10	5·2
Melbourne	...	...	...	...	...	...	...	...	...	...	...	...	...
Adelaide	106·3	5	51·6	25	85·7	60·4	51·5	44	167·0	41·3	·33	2	3·0
Perth	98·0	25	54·6	28	81·2	61·5	58·4	65	159·6	49·0	·26	2	2·7
Coolgardie	111·6	22	56·8	2*	95·1	63·0	49·2	31	170·2	56·0	·17	2	2·0
Brisbane	94·6	26	63·6	12	86·6	69·5	64·8	66	158·1	58·9	·32	3	4·4
Hobart, Tasmania ..	87·8	2	42·6	26	69·4	51·4	45·4	54	154·9	38·9	2·05	14	5·8
Wellington ...	71·8	28	43·5	12	65·2	55·4	52·0	74	143·0	32·1	3·74	10	7·1
Jamaica, Kingston ..	88·9	20	65·3	5	85·7	69·4	67·6	78	...	...	2·17	8	3·8
Grenada	85·0	Sev.	70·0	Sev.	83·0	72·0	...	73	137·0	...	2·81	17	2·5
Toronto...	46·9	22	0·5	10	36·6	21·9	22·4	81	115·6	—4·8	1·04	13	6·8
Fredericton	41·0	22	—16·0	28	30·7	12·3	14·3	76	48·0	...	1·75	8	...
St. John, N.B. ...	46·3	2	—12·5	12	30·6	14·7	17·0	79	114·2	—13·0	5·61	16	6·7
Victoria, B.C.	52·0	13	33·0	30	45·0	37·6	39·0	89	99·0	23·0	5·81	16	7·8

*6 and 25.

Johannesburg.—Bright sunshine 252·0 hours.

COLOMBO, CEYLON.—Mean temp. 80°·5, or 1°·6 above, dew point 1°·5 above, and R 1·04 in. above, averages. Mean hourly velocity of wind 4·2 miles. T8S on 5 days. Storm on 31st with 1·70 in. of R.

HONGKONG.—Mean temp. 61°·5. Bright sunshine 81·8 hours. Mean hourly velocity of wind 13·8 miles.

Sydney.—R below average. Very severe T and H storm on 19th.

Adelaide.—Mean temp. 1°·0 below, and R ·39 in. below, averages.

Perth.—R ·08 in. below average.

Coolgardie.—Temp. 1°·7 above, and R about ·30 in. below, averages.

Brisbane.—Temp. slightly above, and R below, averages for 12th successive month.

Wellington.—Mean temp. same as average, and R ·45 in. above average. Bright sunshine, 179·5 hours. Weather unsettled, with strong N.W. winds.

Symons's
Meteorological Magazine.

No. 643. AUGUST, 1919. Vol. LIV.

THE BRITISH RAINFALL ORGANIZATION AND THE METEOROLOGICAL OFFICE.

At the annual meeting of the Trustees of the British Rainfall Organization on July 23rd, 1919, an agreement with the Director of the Meteorological Office was signed which marks an important step in the co-ordination of the meteorological services of the country.

Dr. H. R. Mill, who has been the unpaid Director of the British Rainfall Organization since January 1st, 1901, when he joined Mr. H. Sowerby Wallis, who retired in 1903, had presented the accumulated rainfall records, the instruments at 62, Camden Square, and other property, to Trustees in 1910 to be held for the public benefit, reserving the right to use the records and the services of the assistants in his professional work as a rainfall expert. On the breakdown of his eyesight in 1913, Dr. Mill took a long holiday, and, on returning to this country, in 1914, he was making arrangements for retiring when the war broke out and he postponed the step until a more convenient season. As the result of an accident last year his health was further impaired, and he has now resigned the directorship of the Organization and has given up his professional work and all engagements, except the membership of the Board of Trade Committee on the Water Power Resources of the United Kingdom, which he hopes to retain until the final report of the Committee is prepared. The Trustees in the circumstances considered that the time was favourable for giving effect to a plan which had often been under consideration, whereby the cordial relations of the Organization and the Meteorological Office should be made still closer, to the advantage of both, and the furtherance of meteorological science. It has accordingly been arranged that from July 24th the Meteorological Office should assume

responsibility for the work of the British Rainfall Organization, taking over the custody of the records, the services of the staff, and occupying the offices at 62, Camden Square, which have been leased to the Government by the Trustees. With the sanction of H.M. Treasury, Sir Napier Shaw, on the part of the Meteorological Office, undertakes to continue the annual issue of "British Rainfall" and the monthly publication of *Symons's Meteorological Magazine* on their present lines, so far as these may not be modified by future expansion and improvement.

Mr. Salter, who has been joint-Director with Dr. Mill for the last year, and whose connection with the Organization goes back to the time of Mr. Symons, the founder, has been appointed Superintendent in charge of the rainfall work, which will be carried on without interruption at the old address.

In consideration of the property transferred, the Government has paid over to the Trustees a sum sufficient to allow them to purchase an annuity for Dr. Mill as an equivalent for the rights retained by him under the Trust Deed, which he has now relinquished.

The Trustees are satisfied that the course they have followed is the best possible in the circumstances and they believe that the prestige of a unified national meteorological service will enable a fuller development of rainfall research than would have been possible under private management, while the flexibility and vitality of the voluntary system of observing is safe-guarded by the retention of the old staff under Mr. Salter.

RETIREMENT OF DR. H. R. MILL.

To the Readers of "Symons's Meteorological Magazine."

WITH the arrangement of the contents of this number my editorship of this Magazine comes to an end, but the Magazine will, I trust, go on its way to ever-growing importance. I have been responsible for 222 numbers which have been issued since February 16th, 1901, allowing for some months in 1918 and 1914, when I was on the other side of the world. Until the war made the mere maintenance of existence an aim worth striving for, I endeavoured to the best of my ability to make each number better than the one before, and I am sure that my successor will do no less.

To the regular readers, and especially to those who have kept our correspondence pages filled and overflowing for fifty-four years with experience and criticism, I wish to record my grateful thanks. I would also thank the staff of the British Rainfall Organization, on whom has fallen the burden of routine work, the perfect performance of which is attested by the punctuality of the appearance of this Magazine. In particular I must record my great indebtedness, especially in recent years, to Mr. Salter, who

has always assisted me and often taken my place in the editorial work. No editor was ever better served by printers and engravers than I have been by Messrs. Shield and Spring, whose press has produced every number of this Magazine, and by Messrs. Bale, Sons and Danielsson, who have produced all the illustrations for the last nineteen years.

I take leave of all with the utmost regret, but not before I have seen provision made for a future of wider usefulness for this Magazine than my impaired health could possibly allow me to secure for it by retaining control. The times demand a fresh outlook and a vigorous grasp of new ideas and impending developments in the science and the practice of meteorology, and I confidently hope that *Symons's Meteorological Magazine* will at last shake off the limitations of the past and find its true place in the sun.

John Hopkinson, F.L.S., F.G.S.

1844—1919.

We learn with regret of the death on July 5th of Mr. John Hopkinson, of Watford, at the age of 74. Mr. Hopkinson was a familiar figure to all who were in the habit of attending scientific meetings in London, and his interests were very wide. He edited for more than forty years the Transactions of the Hertfordshire Natural History Society, including rainfall tables for the county, and was Secretary from 1875-91 and President in 1891-93. He was for many years a member of the Council, and was a past Vice-President, of the Royal Meteorological Society, and he established the well-equipped meteorological observatory at the Herts. County Museum at St. Albans, taking much trouble in arranging for its continuance after his death. In 1899, Mr. Hopkinson became Treasurer of the Rae Society, dealing with natural history in the widest sense and his later years were devoted largely to work on their publications. He wrote numerous papers on scientific subjects, being specially interested in natural history and geology, whilst his associateship of the Institution of Civil Engineers spoke of a lively interest in the practical application of scientific knowledge to economic purposes. In this connection it may be noted that he was a recognized authority on the underground water in the chalk.

As an Observer of many years standing to the British Rainfall Organization, and especially in his capacity as collector of local rainfall records for Hertfordshire, Mr. Hopkinson was always ready to extend courteous help to us in our work, and the loss of his genial co-operation will be severely felt.

Walter Gould Davis.

1851—1919.

We regret to announce the death on April 30th, at Danville, Vermont, U.S.A., of Mr. W. G. Davis, the well known Argentine meteorologist and director of the National Weather Bureau of Argentina from 1885 to 1915. Originally trained as a civil engineer Mr. Davis, in the early seventies, joined his uncle, Dr. Gould, of the Cordoba Astronomical Observatory, and on the retirement of the latter was appointed director of the newly established meteorological section, which at that time consisted of less than twenty stations. Under Mr. Davis the service rapidly developed and on his retirement the number of meteorological stations had increased to nearly two hundred, with ten times as many rainfall stations. In 1901 the central office was removed from Cordoba to Buenos Aires, and Mr. Davis was thereby enabled to carry out a scheme for the production of a daily weather map on a comprehensive scale, co-operation with other South American States resulting in a map extending from the Equator to the Straits of Magellan. The rainfall data contained in the 8 a.m. map were based on returns telegraphed from 1,350 points, probably a unique achievement in rapid mapping of meteorological data upon an extended scale. In 1902 Mr. Davis established the hydrometric section of the Argentine Meteorological Office, and soon after all the principal rivers and lakes were under observation. A magnetic observatory was established in 1904, from which magnetic surveys were from time to time organized. In the same year Mr. Davis took over the sub-Antarctic station in the South Orkneys, founded the year previous by the *Scotia* Antarctic Expedition, and in 1905 absorbed into his service for the continuation of this work the staff of the Ben Nevis Observatory, which had then been recently closed.

Mr. Davis was elected a member of the International Meteorological Committee in 1894, and an Honorary Fellow of the Royal Meteorological Society in 1898.

His contributions to meteorology are contained in thirteen quarto volumes of the "Anales" of the Oficina Meteorológica Argentina. He also wrote three works on the "Climate of the Argentine Republic," published in 1889, 1902 and 1910 respectively, and a general summary of his thirty years' labour in 1914, under the title "History and Organization."

As a director, Mr. Davis enjoyed the respect and appreciation of the executive officials through many changes of Government, while his generous gift of friendship and undeviating amiability endeared him to his whole staff down to the humblest messenger in the service. R.C.M.

Correspondence.

To the Editor of Symons's Meteorological Magazine

SNOWFALL AROUND THE SPRING EQUINOX.

I do not know whether Mr. Preston is right in ascribing a special tendency to snowfall in the week immediately about the Equinox, but there is certainly a great tendency for snowfall in the British Isles throughout the month of March and even April, that is to say, during the spring or equinoctial period. In fact on general climatic experience without having made a statistical investigation I should say that in quite five English Marchs out of ten snow is a more common precipitate than rain, and it commonly comes in the form of bitter squalls of very pure dry flakes indeed. Snow is about as common round the spring equinox as it is round the winter solstice and the explanation of the anomaly is not difficult. Not only is the mean temperature in our maritime northern country slower to rise in spring than in continental regions in the same latitude, but this tendency is enhanced by the frequency with which the pressure distribution at that season favours a flow of air from Polar regions. Thus it often happens that a mild, open, rainy winter is followed by a rather dry and frosty spring in which snowfall figures more prominently than rainfall; and it is certainly true to say that we are very liable in England to experience an Atlantic winter followed by an Arctic spring.

An interesting feature to note in connection with spring snowfalls is this: that snow showers are apt to occur in spring with considerably higher maximum day temperatures than in winter and for the following reason. In March during a cold northerly type the actual surface air temperature in sunny intervals between snow squalls may rise to between 40° and 50° F., that is to say the actual temperature in what is *potentially* a very cold wind may be locally quite high; whereas in December or January a temperature between 40° and 50° F. signifies a mild type of weather, with what I might be permitted to call a high potential temperature, in which conditions only rain can fall.

L. C. W. BONACINA.

27, Tanza Road, Hampstead, N.W. 3, June 20th, 1919.

LOW JULY MAXIMUM.

The maximum temperature here to-day was 52°·7 F., probably the lowest maximum recorded for a century for July 20th in the south of England. At Greenwich the lowest maximum for this date was 58°, in 1902.

The lowest maximum at Greenwich for any day in July since 1841 was 55°·9, on July 12th, 1888.

The maximum temperature to-day was equal to the mean maximum of March 29th and November 4th, at Greenwich.

As the *minimum* temperature of to-day was 50°·7, the diurnal range was only 2°, which is very remarkable.

H. K. G. ROGERS.

"Glenart," Weybridge, July 20th, 1919.

[Dr. H. R. Mill reports a maximum reading of 52°·1 on the same day at Dorman's Park, Surrey, at 320 feet above sea-level. This reading was made in the evening and would have been lost if the maximum temperature had been taken at 9 a.m. next day, when the thermometer stood at 59°·1. Mr. Rogers's station is at an altitude of 85 feet and Greenwich, 150 feet.—ED., *S.M.M.*].

A RAINFALL CONTRAST.

MR. DANSEY'S interesting communication shows that an excess of rain in January, February and March of 5·17 in. was followed by a deficit in April, May and June of 4·24 in. There is an old saying,

"Never a debt is paid so nigh
As the wet will pay the dry."

In view of the above figures might we not also say,

"Better paid was never debt
Than the dry will pay the wet.'

A.F.

Failand, near Bristol.

SNOW FOLLOWING FINE WEATHER.

By M. A. GIBLETT, B.Sc.

WITH reference to the correspondence in the issues of this magazine for March, April and May of this year, concerning the occurrence of snow following a soft warm day in the latter part of February or in March, I have, at the suggestion of Mr. J. S. Dines, endeavoured to obtain some estimate of the frequency of occurrence of snow following closely on a period of high maximum temperature. In the accompanying table is given the result of examining the weather reports sent in daily to the Meteorological Office during the period from mid-February to the end of March in the ten years 1910-1919. Included in the table are (*a.*) the number of periods of consecutive days on which the maximum temperature of a selected station in the Midlands, reached 50°F., (*b.*) the number of these occasions which

were followed within 3 days by snow in the part of England south of about Spurn Head; (*c.*) the total number of periods of consecutive days on which snow fell in that part of England.

Mid-February to End of March	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	Total 1910 to 1914	Total 1915 to 1919	Total 1910 to 1919
(*a.*) Number of periods with maximum of 50°F. or more at inland station	6	6	7	5	8	6	6	2	6	4	32	24	56
(*b.*) Number of occasions on which snow followed within 3 days	3	2	2	3	6	5	4	2	2	3	16	16	32
(*c.*) Total number of periods of snow ..	5	3	2	4	6	6	4	3	2	6	20	21	41

The totals for the first five years are in fair agreement with those for the latter five. The ten-year totals for (*a.*) and (*b.*) show that snow followed within three days on 57 per cent. of the occasions on which there was a period with a maximum temperature of at least 50°F., while from (*b.*) and (*c.*) we see that these occasions of snow formed 78 per cent. of the total number of periods of snow. Thus more than three-quarters of the occasions of snow occurred within three days after a period of high maximum temperature. This appears to afford a striking confirmation of the statement made by Dr. C. P. Hooker.

An examination of the weather maps shows that these phenomena cannot be attributed to any one definite sequence of changes in the pressure distribution. The period of high maximum temperature seems to occur either in the rear of an anticyclone which is moving eastwards as a depression advances from the Atlantic, or with the winds of the S.W. quadrant in the right front of a depression moving in a track north of the station.

In the first case, if the depression takes a southerly track the snow may occur with the north or north-east winds in its rear, while if, as in the second case, the track taken is to the north of the station, then the snow occurs either in the north or north-west winds in the rear of the depression, or more frequently in the rear of small secondaries or depressions which subsequently pass eastwards across the south of England. The occasion of March 10th, mentioned by Dr. Hooker, in his letter in the May issue, affords an illustration of the last type. The maximum of 55° F. occurred while a depression was situated to the north-west of Ireland. This depression subsequently moved north-eastwards to Scandinavia, while a secondary passing from west to east across the south of England was accompanied by snow in its rear on the 12th.

AMALGAMATION OF METEOROLOGICAL SERVICES.

It is announced by *The Times* that a scheme for the amalgamation of the existing Government Meteorological Services has been approved, and details are being arranged. Under the stress of war conditions the Meteorological Office was supplemented by the addition of three specially organized services, respectively in charge of the Admiralty, the Army and the Air Ministry, and the coming of peace thus found four more or less overlapping departments. The present scheme brings them together under the directorship of Sir Napier Shaw, who has acted for some time past in the capacity of Meteorological Adviser to the Government. The new amalgamated service will meet the requirements of the Army, Navy, Royal Air Force, of civil aviation, fisheries, engineering, and of all others who require meteorological information. It will be in close touch with all colonial and foreign observatories, and will bring together information from all parts of the world.

The department will come under the Controller-General of Civil Aviation and the headquarters will most probably be at the Air Ministry, though it is understood that the expenses will not come into the Air Estimates, being met by a special grant.

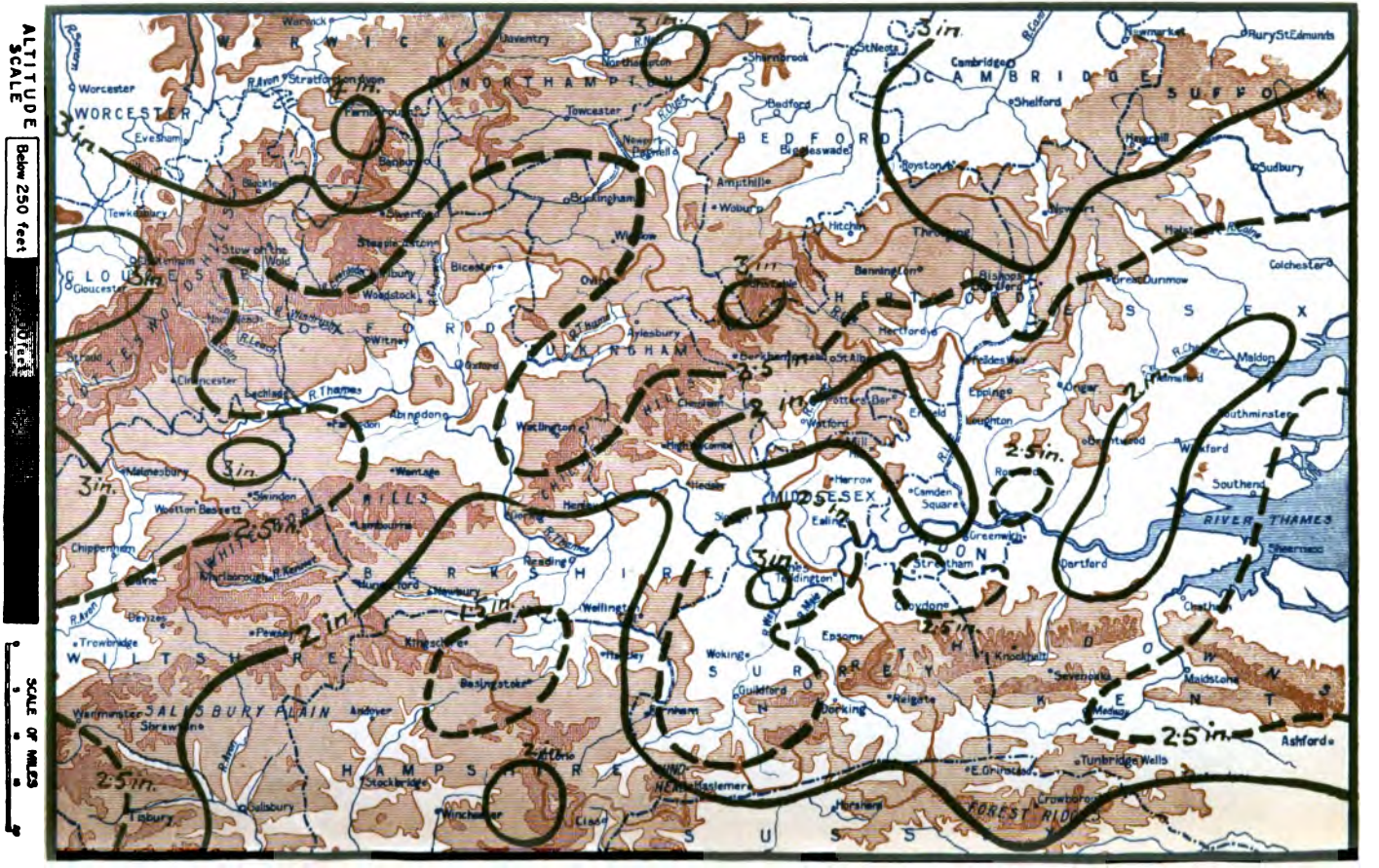
METEOROLOGICAL NEWS AND NOTES.

British Rainfall, 1918, is now in the hands of the printers and it is hoped that it will be possible to issue it somewhat earlier than in the last two years. Any Observers whose records have not yet been sent in should post them immediately to 62, Camden Square, N.W. 1, in order that they may be inserted in the proofs before passing them for press.

A Cornwall Rainfall Association has been formed for the purpose of stimulating rainfall reading in the county, and held its first meeting at Falmouth, on July 16th. The Association proposes to work for the establishment of new stations, to inspect rain gauges and bring together records for publication, and will operate in informal association with the British Rainfall Organization. All who are interested in these objects should communicate with the Hon. Secretary, Mr. A. Pearce Jenkin, of Trewirgie, Redruth.

Peace Day, July 19th, was marked by exceptionally heavy rainfall in parts of the English Midlands, and we learn that during the twenty-four hours, ending at 9 a.m. on the 20th, 2·45 in. had fallen at Gloucester and 2·04 in. at Sheffield.

THAMES VALLEY RAINFALL JULY, 1919.



Symons's Meteorological Magazine.

Watershed of River Thames above Teddington and River Lee above Feildes Weir.

Isohyetals

THE WEATHER OF JULY.

THROUGHOUT the greater part of last month there was a constant proclivity for an extension northwards of the anticyclonic system which is centred, in an ordinary July, over the Azores region. As a result the prevailing winds in this country were not merely of oceanic origin, but came from high latitudes, more often than not from the northward or north-westward, and in some few instances from the north-eastward. The mean temperature of the month was consequently below the average, and especially so over eastern and central England. At Kew Observatory the mean of the daily maximum temperatures, 65°·0, was 6° below the average, and was lower than in any July since 1888. In the same neighbourhood the mean of the night temperatures (the shade minima) was the lowest observed in a record extending back to 1871.

During the first 5 days of the month a shallow barometical depression moved slowly southwards over England and the North Sea and occasioned very cool winds from N., varying to N.E., thunderstorms being experienced in several parts of England and Ireland between the 2nd and 4th. Between the 6th and 8th the nights were very cold, with slight ground frost locally in the west and north. An anticlyclone afterwards spread over the country from the north-westward, and on the 10th and 11th the thermometer over a large portion of Great Britain rose to between 75° and 80°. Later on the anticyclone withdrew in a south-westerly direction and cool winds from W. and N.W. set in, frost being experienced in Scotland on the nights of the 12th and 13th; on the grass the thermometer sank to 26° at Crathes and 27° at Balmoral.

On the 18th the wind in the front of an advancing depression backed temporarily to S.W. or S. and the thermometer rose slightly above 75° in many parts of England. The depression afterwards moved eastward directly across the United Kingdom and occasioned heavy rain in many districts. In its rear the wind shifted to N.W. and N. and a great fall of temperature took place over England, the maximum reading, at Kew, on the 20th (54°), being 23° lower than that of the 18th. At the close of the month, when the wind backed to W. or S.W., the thermometer rose briskly, and on the 31st it exceeded 75° in the east and south-east of England.

The total duration of bright sunshine exceeded the average in the west and north, but was considerably below it in the eastern and central districts. In a normal July the amount of sunshine at Falmouth is not appreciably greater than at Kew; last month the western station enjoyed twice as much as the metropolitan Observatory.

Rainfall was as a rule deficient, being remarkably so in parts of the east of Scotland and of Ulster. Less than an inch fell widely in these districts. All parts of Scotland and Ireland had less than the average rainfall, and this was also the case in the greater part of Wales and in parts of England, but belts of relatively high rainfall stretched across England and Wales between Dartmoor on the south-west, and the east coast from Yorkshire to Norfolk on the north-east. A number of patches in the Midlands had more than 3 inches, the total rising to more than 4 inches in places. This amount also fell locally in the mountains of Wales. The general rainfall for England and Wales was 74 per cent. of the average, for Scotland 36 per cent., and for Ireland 45 per cent., the fall for the British Isles as a whole being 55 per cent. of the average.

In London (Camden Square) the weather was dull and cool with the exception of a few days, mostly in the middle of the month. The mean temperature 59°·3 was 4°·2 below the average and the lowest for July in the 62 years' record excepting 1879 (59°·1) and 1888 (58°·9). Duration of sunshine 108·9 hours, and of rainfall 49·1 hours. Evaporation 1·90 inches.

Printers' error in June, line 45; *for* nearly 1 *read* nearly 15.

RAINFALL TABLE FOR JULY, 1919.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875–1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·57	1·75	— ·82	68	·30	11	14
Tenterden	*Kent*	2·21	1·71	— ·50	77	·38	12	15
Arundel (Patching)	*Sussex*	2·46	1·87	— ·59	76	·65	19	13
Fordingbridge (Oaklands)	*Hampshire*	2·14	1·67	— ·47	78	·57	19	11
Oxford (Magdalen College)	*Oxfordshire*	2·43	2·15	— ·28	88	·74	19	12
Wellingborough	*Northampn*	2·54	2·23	— ·31	88	·54	12	12
Bury St. Edmunds (Westley)	*Suffolk*	2·68	3·97	+1·29	148	1·33	20	18
Geldeston [Beccles]	*Norfolk*	2·37	2·63	+ ·26	111	·55	11	18
Polapit Tamar [Launceston]	*Devon*	2·74	·98	—1·76	36	·19	21	13
Rousdon [Lyme Regis]	,,	2·68	2·42	— ·26	90	·97	19	10
Ross (Birchlea)	*Herefordshr.*	2·75	2·69	— ·06	98	1·20	19	14
Church Stretton (Wolstaston)	*Shropshire*	2·58	*2·74*	+ ·16	106	·48	2	*14*
Boston	*Lincoln*	2·35	2·50	+ ·15	106	·62	11	17
Worksop (Hodsock Priory)	*Nottingham*	2·35	2·40	+ ·05	102	·76	19	12
Mickleover Manor	*Derbyshire*	2·57	2·34	— ·23	91	·77	19	12
Congleton (Buglawton Vic.)	*Cheshire*	3·03	2·19	— ·84	72	·42	19	14
Southport (Hesketh Park)	*Lancashire*	2·92	1·48	—1·44	51	·36	3	9
Wetherby (Ribston Hall)	*York, W.R.*	2·56	2·77	+ ·21	108	·76	19	10
Hull (Pearson Park)	,, *E.R.*	2·39	1·94	— ·45	81	·38	19	14
Newcastle (Town Moor)	*North'land*	2·90	1·60	—1·30	55	·48	2	10
Borrowdale (Seathwaite)	*Cumberland*	8·91	3·75	—5·16	42	...	...	...
Cardiff (Ely)	*Glamorgan*	3·26	1·77	—1·49	54	·66	19	11
Haverfordwest	*Pembroke*	3·39	·78	—2·61	23	·37	17	9
Aberystwyth (Gogerddan)	*Cardigan*	4·03	2·62	—1·41	65	·69	21	11
Llandudno	*Carnarvon*	2·52	1·35	—1·17	54	·45	21	13
Cargen [Dumfries]	*Kirkcudbrt.*	3·20	1·36	—1·84	43	·77	31	4
Marchmont House	*Berwick*	3·30	·62	—2·68	19	·15	2	8
Girvan (Pinmore)	*Ayr*	3·73	1·09	—2·64	29	·72	31	6
Glasgow (Queen's Park)	*Renfrew*	2·91	·73	—2·18	75	·41	30	4
Islay (Eallabus)	*Argyll*	3·41	2·26	—1·15	66	·94	18	9
Mull (Quinish)	,,	4·12	1·86	—2·26	45	·73	18	15
Loch Dhu	*Perth*	4·69	2·50	—2·19	53	1·00	18	6
Dundee (Eastern Necropolis)	*Forfar*	2·84	·69	—2·15	24	·30	18	5
Braemar	*Aberdeen*	2·65	·49	—2·16	19	·24	18	3
Aberdeen (Cranford)	,,	3·00	1·03	—1·97	34	·37	21	10
Gordon Castle	*Moray*	3·25	·59	—2·66	18	...	...	...
Drumnadrochit	*Inverness*	3·37	·92	—2·45	27	·28	21	8
Fort William	,,	4·92	1·56	—3·36	32	·63	31	8
Loch Torridon (Bendamph)	*Ross*	5·35	2·44	—2·91	45	·58	30	11
Dunrobin Castle	*Sutherland*	2·91	1·41	—1·50	48	·45	19	6
Glanmire (Lota Lodge)	*Cork*	2·73	1·37	—1·36	50	·56	4	8
Killarney (District Asylum)	*Kerry*	3·53	2·42	—1·11	69	·57	18, 20	15
Waterford (Brook Lodge)	*Waterford*	3·13	1·51	—1·62	48	·44	18	10
Nenagh (Castle Lough)	*Tipperary*	3·02	1·63	—1·39	54	·61	18	9
Ennistymon House	*Clare*	3·57	2·14	—1·43	60	·51	4	12
Gorey (Courtown House)	*Wexford*	2·90	1·08	—1·82	37	·36	5	6
Abbey Leix (Blandsfort)	*Queen's Co.*	2·99	1·78	—1·21	59	·65	21	10
Dublin (Fitz William Square)	*Dublin*	2·60	1·13	—1·47	43	·45	21	11
Mullingar (Belvedere)	*Westmeath*	3·16	1·26	—1·90	40	·40	17, 20	7
Crossmolina (Enniscoe)	*Mayo*	3·26	1·46	—1·80	45	·43	21	13
Cong (The Glebe)	,,	3·72	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	3·36	1·99	—1·37	59	·66	13	14
Seaforde	*Down*	3·32	·40	—2·92	12	·31	18	5
Ballymena (Harryville)	*Antrim*	3·44	1·05	—2·39	31	·32	18	8
Omagh (Edenfel)	*Tyrone*	3·34	·82	—2·52	25	·40	18	7

SUPPLEMENTARY RAINFALL, JULY, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Sevenoaks, Speldhurst Close.	2·14	XI.	Lligwy	1·61
,,	Ramsgate	2·87	,,	Douglas, Isle of Man	...
,,	Hailsham	1·37	XII.	Stoneykirk, Ardwell House...	·52
,,	Totland Bay, Aston House...	...	,,	Carsphairn, Shiel	1·50
,,	Stockbridge, Ashley	1·73	,,	Langholm, Drove Road	1·16
,,	Grayshott	1·64	XIII.	Selkirk, The Hangingshaw..	·57
,,	Upton Nervet	1·47	,,	North Berwick Reservoir	·88
III.	Harrow Weald, Hill House...	2·28	,,	Edinburgh, Royal Observaty.	·63
,,	Pitsford, Sedgebrook	2·51	XIV.	Biggar	·71
,,	Woburn, Milton Bryant	3·44	,,	Maybole, Knockdon Farm ...	·76
,,	Chatteris, The Priory	2·52	XV.	Shiskine	1·55
IV.	Elsenham, Gaunts End	2·49	,,	Ardgour House	3·44
,,	Rayleigh	1·93	,,	Oban	1·45
,,	Colchester, Hill Ho., Lexden	2·11	,,	Holy Loch, Ardnadam	2·35
,,	Aylsham, Rippon Hall	3·31	,,	Loch Venachar	1·65
,,	Swaffham	2·98	XVI.	Glenquey	1·90
V.	Bishops Cannings	2·32	,,	Loch Rannoch, Dall	·33
,,	Weymouth	2·17	,,	Blair Atholl	...
,,	Ashburton, Druid House	1·38	,,	Coupar Angus	·51
,,	Cullompton	1·46	,,	Montrose, Sunnyside Asylum.	·58
,,	Lynmouth, Rock House	1·09	XVII.	Balmoral	·34
,,	Okehampton, Oaklands	1·71	,,	Fyvie Castle	1·22
,,	Hartland Abbey	1·04	,,	Keith Station	...
,,	St. Austell, Trevarna	·78	XVIII.	Rothiemurchus	...
,,	North Cadbury Rectory	2·68	,,	Loch Quoich, Loan	5·90
VI.	Clifton, Stoke Bishop	2·84	,,	Skye, Dunvegan	2·93
,,	Ledbury, Underdown	2·85	,,	Fortrose	·44
,,	Shifnal, Hatton Grange	2·60	,,	Glencarron Lodge	1·90
,,	Droitwich	3·16	XIX.	Tongue Manse	·77
,,	Blockley, Upton Wold	3·00	,,	Melvich	·69
VII.	Grantham, Saltersford	4·29	,,	Loch More, Achfary	2·99
,,	Louth, Westgate	2·76	XX.	Dunmanway, The Rectory	1·36
,,	Bawtry, Hesley Hall	2·80	,,	Mitchelstown Castle	1·76
,,	Derby, Midland Railway	2·66	,,	Gearahameen	3·50
VIII.	Nantwich, Dorfold Hall	1·79	,,	Darrynane Abbey	1·74
,,	Bolton, Queen's Park	1·84	,,	Clonmel, Bruce Villa	1·36
,,	Lancaster, Strathspey	1·21	,,	Roscrea, Timoney Park	1·56
IX.	Langsett Moor, Up. Midhope	...	,,	Broadford, Hurdlestown	2·23
,,	West Witton	2·15	XXI.	Enniscorthy, Ballyhyland...	1·30
,,	Scarborough, Scalby	2·94	,,	Rathnew, Clonmannon	·80
,,	Ingleby Greenhow	3·52	,,	Hacketstown Rectory	1·49
,,	Mickleton	1·70	,,	Ballycumber, Moorock Lodge	1·25
X.	Bellingham, High Green Manor	1·41	,,	Balbriggan, Ardgillan	·66
,,	Ilderton, Lilburn Cottage	1·01	,,	Castle Forbes Gardens	1·13
,,	Keswick, The Bank	1·49	XXII.	Ballynahinch Castle	1·78
,,	Orton	1·73	,,	Woodlawn	2·20
XI.	Llanfrechfa Grange	1·89	,,	Westport House	1·28
,,	Treherbert, Tyn-y-waun	1·60	,,	Dugort, Slievemore Hotel	...
,,	Carmarthen, The Friary	1·41	XXIII.	Enniskillen, Portora	·71
,,	Fishguard, Goodwick Station.	·91	,,	Dartrey [Cootehill]	·61
,,	Crickhowell, Tal-y-maes	1·00	,,	Warrenpoint, Manor House	·54
,,	Birmingham WW., Tyrmynydd	1·74	,,	Belfast, Cave Hill Road	·68
,,	Lake Vyrnwy	1·12	,,	Glenarm Castle	·48
,,	Llangynhafal, Plas Drâw	2·65	,,	Londonderry, Creggan Res.	1·42
,,	Rhiwbryfdir	3·07	,,	Milford Manse	...
,,	Dolgelly, Bryntirion	2·79	,,	Killybegs	...

ERRATUM.—June, 1919, at Llangynhafal, Plas Drûw, *for* 3·69 *read* 2·59.

Climatological Table for the British Empire, February, 1919.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	51·7	22	15·4	9	41·0	30·5	33·4	93	82·6	13·3	2·64	14	8·1
Malta	69·4	18*	44·0	14	60·4	51·0	...	84	121·5	42·5	1·19	12	2·9
Lagos	91·3	24	72·5	8	89·5	77·5	78·3	82	162·4	65·2	2·74	4	6·4
Cape Town	103·4	5	54·0	24	80·9	62·6	58·3	65	...	...	1·56	6	3·6
Johannesburg	89·9	8	47·2	4	77·6	56·5	54·0	74	...	44·4	3·33	8	4·7
Mauritius	89·2	4	70·3	4	86·8	74·0	71·2	76	...	65·3	5·71	13	6·0
Bloemfontein	95·8	7	46·4	26	88·0	58·5	54·6	50	...	...	·48	4	3·1
Calcutta...	87·3	27	52·4	4	82·1	60·3	57·4	63	...	41·4	1·16	1	2·5
Madras	93·5	18	68·4	23	87·7	71·4	69·5	74	160·1	65·2	·00	0	2·8
Colombo, Ceylon ...	91·8	5†	69·0	7	89·7	73·6	71·6	76	162·5	61·7	·34	5	4·2
Hongkong	72·5	27	39·4	4	61·7	55·0	51·8	79	...	...	1·51	8	7·5
Sydney	97·4	18	57·1	2	81·1	66·4	63·1	67	148·8	52·0	5·26	10	4·9
Melbourne	106·6	15	51·2	1	81·8	60·5	56·4	60	151·0	42·0	3·65	5	3·9
Adelaide	105·1	14	54·8	20	86·7	64·9	57·1	52	162·8	46·0	2·68	6	3·8
Perth	103·0	23	49·4	16	82·7	60·9	55·7	58	166·3	41·0	·90	3	2·9
Coolgardie	107·2	26	50·8	17	92·8	62·6	51·1	37	171·0	49·0	·26	2	3·2
Brisbane	93·1	20	65·0	3	87·1	69·0	67·1	71	156·9	60·7	·89	4	4·4
Hobart, Tasmania ...	82·3	2	45·0	24	71·8	55·5	52·6	67	139·2	39·0	1·51	8	6·7
Wellington	81·1	24	44·9	26	69·6	56·9	54·9	75	152·0	31·6	2·02	3	5·4
Jamaica, Kingston ...	91·5	19	62·6	13	87·0	69·1	66·8	77	...	...	·34	3	2·2
Grenada	88·0	13	70·0	21	83·0	73·0	...	72	137·0	...	1·90	9	2·5
Toronto...	52·7	28	10·2	11	34·9	21·7	20·9	79	96·0	8·0	1·82	12	5·9
Fredericton	38·8	2	−19·0	7‡	25·3	5·7	11·3	83	...	...	4·37	13	6·5
St. John, N.B. ...	39·5	22	5·3	11	30·7	18·4	16·0	76	122·0	4·2	1·84	9	5·3
Victoria, B.C.	50·9	14	27·0	24	44·5	35·6	36·0	85	110·0	19·0	2·75	18	7·5

* and 19. † 6 and 11. ‡ 11 and 12.

Johannesburg.—Bright sunshine 233·8 hours.

COLOMBO, CEYLON.—Mean temp. 81°·6, or 2°·0 above, dew point 1°·3 above, and R 1·62 in. below, averages. Mean hourly velocity of wind 3·3 miles. TS8 on 10th and 11th. Prevailing direction of wind was N.W.

HONGKONG.—Mean temp. 58°·0. Bright sunshine 90·6 hours. Mean hourly velocity of wind 12·3 miles.

Melbourne.—Mean temp. 3°·8 above, and R 1·66 in. above, averages; 3·77 in. of R fell in 24 hours on 17th-18th, a record for a day's fall during 63 years.

Adelaide.—Mean temp. 1°·7 above, and R 2·26 in. above, averages. The wettest February in 81 years' record.

Perth.—R ·44 in. above average.

Coolgardie.—Temp. 1°·7 above, and R ·50 in. below, averages.

Brisbane.—Temp. above, and R below, averages.

Wellington.—Mean temp. 63°·2 or 0°·9 above, and R 1·25 in. below, averages. Bright sunshine, 179·1 hours. Two sunless days.

Symons's Meteorological Magazine.

No. 644. SEPTEMBER, 1919. Vol. LIV.

EDITORIAL.

That the present number of *Symons's Meteorological Magazine* appears without the familiar name of Hugh Robert Mill upon its cover will, we are sure, be a source of deep regret to our readers. For nearly twenty years Dr. Mill has impressed his stimulating personality on this magazine which was brought into being more than half a century ago by the late Mr. G. J. Symons, and which has since his death, in 1900, helped to keep his memory green.

Dr. Mill's nearly twenty years of directorship of the British Rainfall Organization has formed a fitting sequel to the forty years of single-minded and persevering industry by which Mr. Symons had built up a scientific instrument unique of its kind. The great ability and boundless energy of the founder were expended principally upon the work of organization and administration in which his genius chiefly lay. Upon the material which he accumulated Dr. Mill brought to bear a deep scientific insight, combined with that rare faculty for clear demonstration which imparted a peculiar charm to his work. The key to the clearer understanding of rainfall distribution, and the factors which govern it, has been the use of cartographical methods, and a study of the volumes of *British Rainfall* from 1901 onwards in comparison with those of earlier years shows how methodically and successfully this has been developed. Much which Dr. Mill designed to do is, as yet, unfinished, but this at least may be said, that he has shown how the dry bones of statistics may be vitalized by the exercise of scientific imagination, and has thus brought home to thousands the beauty of natural truths in a manner that few investigators have succeeded in doing.

The war, and possibly even in a greater degree, the general trend of thought, have brought us to the time when a closer co-ordination of scientific work has become essential if the greatest good is to be derived from the efforts of all workers. Dr. Mill's retirement occurs at the moment when unification in the meteorological services of the country, the successful carrying out of which he worked hard

and made great personal sacrifices to further, has been secured. In our last number we published, on the authority of *The Times*, a statement of the formation of the new Meteorological organization which has been brought into being under the directorship of Sir Napier Shaw. In the present number we are glad to be able to supplement this statement with an article by Lt.-Col. E. Gold, one of the most eminent pioneers of modern meteorology, setting out some of the aspirations which now promise to come within the range of practical realization. That the British Rainfall Organization will play its part in the shaping of the new meteorological world we have the fullest confidence. The kindly and willing co-operation of the several thousand voluntary helpers will, we feel certain, be so fully maintained, that the organization cannot fail to prove one of the chief corner-stones of British climatology.

For ourselves, the tradition of Dr. Mill's fine example will never fail to be an incentive to carry on worthily the work which he loved so well.

CARLE SALTER.

UNIFICATION OF THE BRITISH METEOROLOGICAL SERVICES.

By Lt.-Col. Gold, D.S.O., F.R.S.

A famous general of the Flying Corps once remarked that, whatever may have been his opinion about the policy of an Allied Supreme Command, he was fully convinced that a single meteorological service was the correct policy for the Western Front. Full inter-allied meteorological unity was never, indeed, achieved, but there was, in the field, a national unity in favourable contrast with the trinities in Paris and London; and there was the closest co-operation between the French, British and American Military Meteorological Services.

With the end of the war the movement for unity gained power, and now at last the British Isles have one Meteorological Service with an establishment of personnel and equipment more in accordance with the importance of the science than the pre-war establishment; which corresponded rather with the humility induced in its devotees by the study of meteorology.

This unification and expansion means for meteorologists increased opportunities and responsibilities; it does not mean a meteorological millenium in which all difficulties of administration vanish and the secrets of isobaric charts stand revealed. Some of the opportunities will present themselves directly, others will only come as a consequence of diligence and research; and at times the meteorologist may have to abandon the policy of waiting for the

opportunity to force him to take it, and adopt instead the policy of seeking the opportunity in spite of the disappointments which inevitably meet the seeker in the barren lands that border on the fertile gardens of his hope.

The British Rainfall Organization became part of the new service on the 24th July—the one hundred and second anniversary of the birth of Sir Richard Strachey—a day of good omen. How can general meteorology and the study of British rainfall both be advanced by the undoubted advantage of the new situation, and to such an extent as to dissipate the fears of stagnation at Headquarters and of alienation of sympathy in the great army of volunteer Observers? In the first place the great collection of records of rainfall can take its place in British climatology and a new edition of "Rainfall Tables of the British Isles" can be issued with monthly and seasonal maps; perhaps, indeed, with ten-day maps, and with the frequency of rainfall days and rainfall duration adequately treated as well as the distribution between night and day. In the second place the study of orographic distribution of rainfall can be taken a step further, by considering it more closely in relation to other meteorological factors such as wind direction; and both orographically and generally the distribution of rainfall requires discussion in relation to the distribution of pressure and temperature. In this connection the "nœuds" or small areas in which the barometric tendency at times exhibits peculiarities should receive special consideration. Finally an opportunity will present itself shortly for securing either international standards of exposure, measurement and publication, or, such an international series of comparisons as will render the rainfall statistics of different countries intercomparable.

By the amalgamation of the Army, Navy and Air Force Meteorological Services with the parent Meteorological Office, the new Service will be able to combine the teachings of meteorological history with the endeavour to secure simplicity and definiteness in meteorological language, codes and phenomena. But it will also have unparalleled opportunities for developing the three-dimensional study of the atmosphere. Given a knowledge of the isobaric distribution at the surface and the temperature distribution at all heights, the supplementary information derived from observations of the wind at all heights will permit the extent of the differences from steady motion to be computed; and the definition of a "disturbance" may take a new form and new light be thrown on the irregularities in the progress and character of disturbances as we know them at present.

Although there are never observations enough, yet there is always a danger of the meteorologist being swamped by the observations and records which pour in upon him: the danger is an increasing one as also is the tendency to regard observations as things of the

moment, to be thrown away or filed for ever, immediately the forecaster has done with them. If the new Service is successful in dealing with this problem its contribution to our knowledge of climate in and above the British Isles, will be a more enduring monument than the apparently ephemeral achievement of an accurate forecast.

Finally, British meteorology is inseparable from the Ocean: the pressing need for economizing our stores of accumulated energy make it desirable that the meteorology of the ocean should be put on a footing from which it can announce the energy practically available in the winds, the rate at which it can be supplied on any route and the routes on which the maximum per mile can be attained. Warnings of gales, ice and fog do not represent the only way in which the meteorology of the sea can contribute to the national welfare; but the effective use of the existing and increasing statistics of marine meteorology depends on a close liaison between the meteorologist, the shipping company and the sailor. With a "meteorologist in every port," this ought now to be practicable.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

UNUSUAL RAINBOW.

I saw a curious rainbow phenomenon last evening which I have never seen before. It was about 7.30 p.m. (summer time), and clearing after a sharp thunderstorm. A fine rainbow developed, especially bright in its northern limb, with the usual faint repetitions inside the main bow and reversed secondary bow outside. The curious thing was a branch of the main bow. This consisted of an arc of a circle of somewhat larger radius than the main bow, which appeared to spring from it about 5° above the visible horizon, which was itself perhaps 15° above the real horizon. The circle of which this branch was an arc was not concentric with the rest of the scheme, but evidently had its centre 15° to 20° higher, and if complete would have appeared as a horse-shoe arch, such as is seen in Moorish architecture. It, however, faded away above where the spectral band widened out considerably so that it looked like a comet's tail. It was not so bright as the main bow, but brighter than the reversed bow. We could not see the western sky where the sun was sinking into the sea, but my theory is that the effect was caused by the reflection of the sun on the sea acting as a secondary source of light.

J. H. FRYER, M.D., CAPT., R.A.M.C.

51st General Hospital, Etaples, B.E.F., 11th May, 1919.

ABSOLUTE DROUGHT.

An absolute drought prevailed here from July 23rd to August 17th (both dates inclusive) a period of twenty-six days. This has only once been exceeded and then by only one day, viz., in July, 1911. Owing presumably to the north—south, instead of the normal south-west—north-east track of depressions, the west of England enjoyed considerably higher day temperatures in July than did the London district. At Kew the mean maximum is given in your last issue as 65°·0; here in was 68°·7. On July 20th, with a maximum at Kew of 54°, and of only 52°·1 at Dormans Park, Surrey, the reading here was as high as 66°. These are unscreened shade temperatures; in a screen my readings would have been slightly higher still.

R. P. DANSEY.

Kentchurch Rectory, Hereford, August, 1919.

SNOW AFTER FINE WEATHER.

I have worked out the last eight years with the following result :—

	February 15th—March 21st.		
Year.	Warm Days.	Days with Snow following.	Total days with Snow.
1912	23	1	2
1913	13	2	3
1914	12	0	3
1915	10	2	4
1916	4	0	15
1917	2	2	8
1918	19	0	2
1919	3	2	10
Eight years	86	9	47

This shows that snow following warm days is not very marked, especially in warm springs, like 1912 and 1918.

H. NOWELL FFARINGTON.

Leyland Auxiliary Climatological Station, Lancs., 1st September, 1919.

RAINFALL CONTRAST.

Here is another version of the old weather saying, which seems to be a better one than that suggested by A. F. in the August number of your magazine :—

> "Never was paid a surer debt,
> Than wet to dry—and dry to wet."

T.S.M.

Basset Down, August 21st, 1919.

RAIN DAYS AND SUMMER SHOWERS.

During June we had a number of showers which seemed to be wetting, but measured very little in the rain gauge. On some of these when one would naturally have spoken of a "wet day," the gauge failed to show ·005 in. I have two gauges side by side, a standard "Snowdon" pattern of galvanized iron, and a copper "British Association" pattern with shallow funnel. On two occasions the latter showed a "rain day" when the former did not. I believe the reason to be that the deep funnel of the Snowdon has a larger surface which must be wetted before the water runs down, and from which evaporation can take place. It also has a larger receiving bottle. Possibly the different specific heats of the materials of which the two gauges are made (iron, ·1138, copper, ·0951) may have an effect. This would favour evaporation from the iron gauge. I have little doubt that in winter these showery days would have been "rain days." For other differences between these two gauges I would refer to my letter in this Magazine, vol. **49,** (1914), p. 18. The rim of the Snowdon is 14½ inches above the ground, and that of the British Association gauge, 10 inches.

Swinton, Berwickshire. A. E. SWINTON.

NOTES ON THE CLIMATE OF MESOPOTAMIA.

By C. H. E. Ridpath.

The climate of Mesopotamia is unique, not, of course, for its shade temperatures of 120° and over, but rather it is the long period of such high temperatures in summer and the spells of cold in winter that make the climate noteworthy.

From about May to September the prevailing wind, known as the Shimral, is north-west. This wind is very persistent during the Indian Monsoon, being part of that system. Dust storms and "dust-devils" of a fairly violent nature occur, but, generally speaking, the wind attains a gusty force, 2 to 4, during the day and dies down at night. In the summer the air is intensely dry, relative humidities under 10 per cent. often being registered. The scorching effect of such a wind at 110° or 120° is therefore intense, yet at the same time the very rapid evaporation of perspiration in one's clothes gives a local but very chilling effect. This dry air, however, inevitably and happily results in comparatively cool nights. The highest minimum in Baghdad in the summer of 1918 was 87°·2, but usually it varied from 75° to 80°. In this connection it is interesting to note how one adapts one's standard of temperatures to prevailing conditions. For instance, one would start playing tennis in the "cool" of the late afternoon when the temperature had sunk to 100° or 95°!

If possible, of course, one sleeps in the open, but the amount of sleep will depend on the goodwill of the sandflies, who are ingeniously designed to get through a mosquito net. Fortunately, a light breeze is sufficient considerably to limit their activities.

It is one long blaze of sun the whole summer. Unfortunately, I have no solar temperature readings before me, but they must be in the region of 170° or 180°. Sunrise in the desert is a wonderful time of beautiful, soft colouring and a freshness in violent contrast to the dazzling glare and fierce heat of the day. The temperature rises rapidly : by 8 a.m., for instance, flying is no longer possible, as engines would seize up. Travelling in trains is forbidden after noon. Even at that hour conditions are not very pleasant in vans with corrugated iron roofs. I remember once having to travel over the desert in a Crossley car rather early in the afternoon, about 4.30 p.m. The engine was running quite normally and we were on top speed, yet the water was boiling within twenty minutes.

The temperatures given in the following table are those taken in a standard Stevenson screen on the roof of the British Residency at Baghdad, beside the left bank of the Tigris. The height above ground level would be about 60 feet, so records are possibly on the low side.

The summer of 1917 had been intensely hot. Amongst many high temperatures the absolute maximum was 122°. The following rainy season however, continued until May, 1918, being about six weeks over the usual time. The Arabs predicted a cool summer, and I am reliably informed the summer I am going to describe was a cool one.

1919. Month.	Mean Max.	Mean Min.	Abs. Max.	Lowest Max.	Highest Min.	Abs. Min.	Days with Max. Shade Temp. Under 90°	90° to 99°	100° to 109°	110° to 120°	Max. Range	Wind Max. Mileage
MAY ...	93·2	68·1	102·9	76·0	73·0	52·5	10	15	6	—	—	321
JUNE...	101·9	75·5	113·6	88·8	85·6	67·6	2	8	14	6	38·3	400
JULY ..	109·2	80·2	117·9	98·4	87·2	71·6	—	1	12	18	39·0	358
AUG. ...	108·0	78·0	116·2	92·3	87·1	70·1	—	3	14	14	37·0	395
*SEPT...	107·1	76·0	113·3	102·7	80·9	72·4	—	—	10	3	35·0	275

1918	Nights Frost	Nights Under 40°	
DEC. ...	5	14	35·0
1919			
JAN. ...	—	16	28·0
FEB. ...	—	7	30·0
MARCH	—	—	26·0
APRIL.	—	—	26·0

* The first 13 days only.

(To be continued).

REVIEW.

Sobre Els Vents Estivals De Convecció à La Costa Catalana. E. Fontseré. Barcelona, 1918. Size, 10½ by 8. Pp. 64. 46 illustrations.

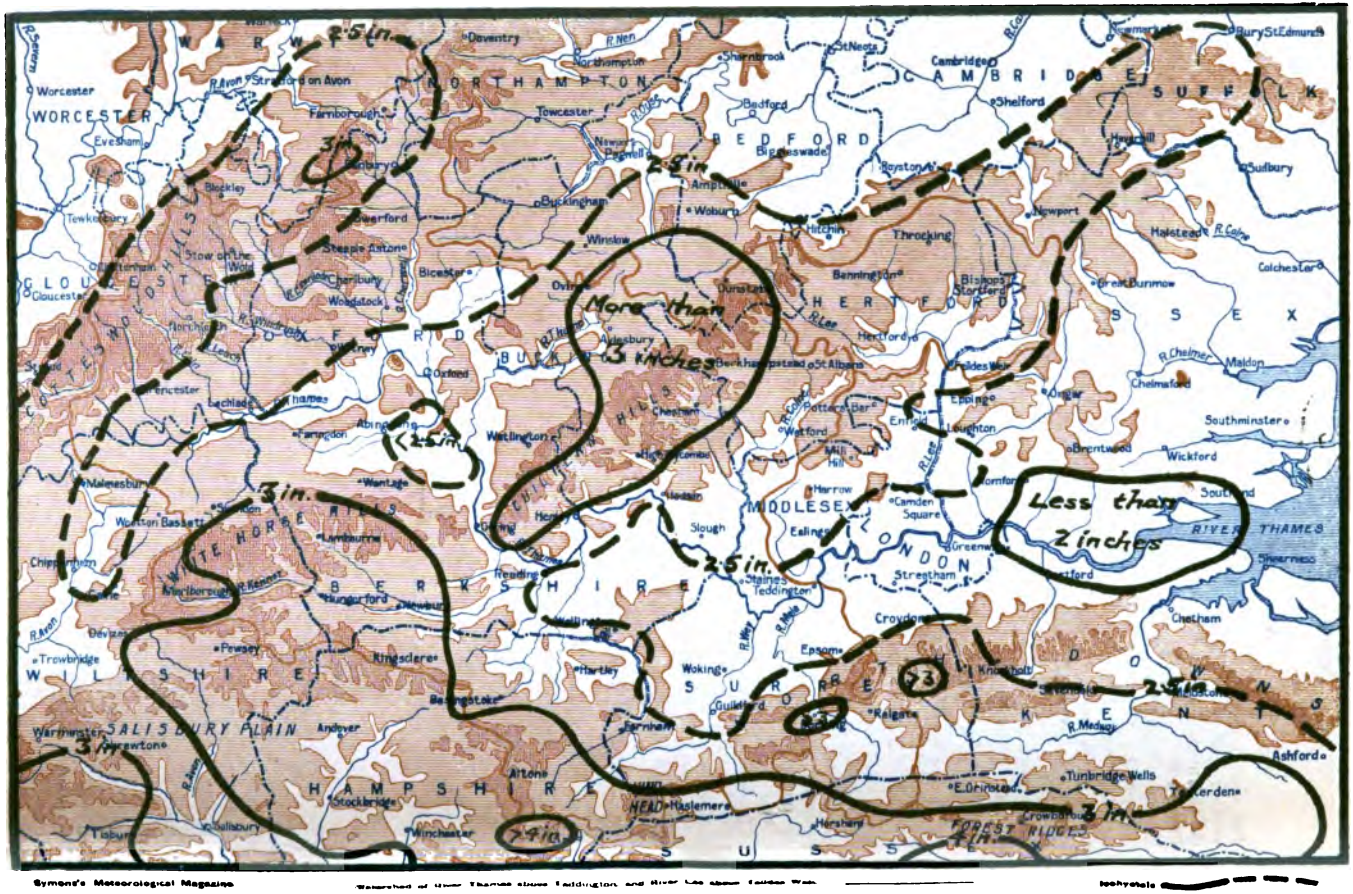
THIS is an important study of the land and sea breezes of Catalana written by the Director of the Aeronautical Station of Barcelona, who is also a Professor of the Faculty of Sciences. Unfortunately the work is written in the local dialect so we cannot pretend to have mastered its contents. The discussion is divided into three sections dealing with observatinos made in Barcelona, supplementary data from the adjacent district, and again in special localities. The services of over thirty volunteer Observers were enlisted, who sent in the data required according to plan. At Barcelona the land breeze sets in during anticyclonic weather after sunset, reaching its maximum velocity at 5 a.m. A complete calm succeeds, but at 8 a.m. the sea-breeze sets in feebly becoming quite marked an hour later and attaining its maximum strength during the hottest hours of the early afternoon. A table is given showing the alternation of land and sea-breezes in 15-day groups, from March to October. The frequency steadily rises from 31 per cent. in the first half of March to 91 per cent. in the last fortnight of July, when it again diminishes, falling to 85 per cent. in the second half of October. A number of maps show the incidence of land and sea breezes at various points and different altitudes along the coast for different hours of the day, with numerous photographic illustrations of clouds of the cumulus type taken at short intervals.

It is to be hoped that this work will be translated into some other languages as an inspection of the illustrations indicates that the results obtained during the investigation are novel and important. It might be possible to make a shot at some of the more striking of these, but it is better not to guess in the present instance, but to await some authorative translation or abstract of the results of what seems to have been a well thought out investigation. R.C.M.

METEOROLOGICAL NEWS AND NOTES.

A CONFERENCE of Meteorologists of the British Dominions will be held in London on September 23rd to 27th. The following have intimated their intention to be present :—Capt. A. J. Bamford, Ceylon; Lt.-Col. D. C. Bates, New Zealand; Mr. H. A. Hunt, Commonwealth of Australia; Mr. H. Knox Shaw, Egypt; Mr. C. Stewart, Union of South Africa; Sir F. Stupart, F.R.S.C., Dominion of Canada; and Dr. G. T. Walker, C.S.I., F.R.S., India. The programme includes visits to the Meteorological Office, the radio-telegraphic stations of the Air Ministry, Kew Observatory, the Meteorological Service of the Admiralty, the British Rainfall Organization and Benson Aerological Observatory.

THAMES VALLEY RAINFALL AUGUST 1919.



WEATHER OF AUGUST.

THE opening days of August were marked by a changeable westerly type of weather, but with a temperature somewhat above the average. On the 2nd the thermometer at many places in the south-east of England rose to between 75° and 80°, and on the night of the 4th, it failed to sink as low as 55°. On the 1st a violent dust storm is reported to have occurred at Catterick, (Yorks).

After the 4th the distribution of pressure became distinctly anticyclonic, and between the 5th and 15th a spell of brilliant summer weather was experienced, the thermometer over a large portion of England rising on several successive days to a maximum of 80° and upwards. The warmest weather occurred between the 9th and 12th, when a number of places recorded shade readings slightly above 85°. During the week ended August 16th between 75 and 80 per cent of the possible duration of bright sunshine was registered at many stations in the east and south-east of England, and as much as 83 per cent. at Worthing. In the London district (as represented by the three stations Westminster, Kew and Bunhill Row), the percentage of sunshine during this brilliant period had been exceeded in only 5 calendar weeks of the previous 38 years, the highest proportion (82 per cent.) occurring in the first week of May in 1909.

After the middle of the month a change to a cool westerly and south-westerly type of weather set in, at first in the north, and afterwards over the country generally. In the southern districts the conditions remained for a time under the partial influence of the anticyclone which was retreating southwards, but in the closing week the weather was everywhere cool and very unsettled, with occasional heavy falls of rain in nearly all districts. Between the 25th and 27th, when the centre of a rather deep cyclonic system moved slowly north-eastwards, across Ireland and Scotland, large amounts of rain were experienced in the far north, and the wind rose to a gale on many parts of our coasts—from S.W. to W. in the south, but from N. and N.E. in the north of Scotland. On the 27th and 28th a well defined secondary depression passed north-eastwards across England, while on the 29th, another small secondary was developed over our southern counties, each disturbance being accompanied by heavy rains over a large portion of England and by thunderstorms in places.

In the Meteorological Office Monthly Fly-sheet, it was remarked, "In August, as in the two preceding months, the rarity of thunderstorms formed a continuing feature in a summer which was characterized in other respects by a large amount of disturbed weather."

The total duration of bright sunshine in August was in most places above the normal, but the excess was nowhere very large.

The total rainfall exceeded the average in the south of England, the west and north of Scotland, and in County Waterford, but the excess was nowhere as much as 50 per cent. of the average. Elsewhere the fall was below the average, the deficiency amounting to 58 per cent. at Braemar. Scattered areas along the east coast and a large area south of the Grampians had a total fall under 2 inches. Practically the rest of Great Britain south of the Moray Firth had from 2 to 4 inches, except the mountain areas. On Dartmoor and in South Wales large areas had more than 5 inches, and this amount fell over nearly the whole of the west of Scotland. Several stations in the Lake District had more than 10 inches and about 15 inches fell on Snowdon, at Loan (W. Inverness) and at Loch More (Sutherland). Rather more than 2 inches fell over the central portion of Ireland, the fall increasing to 4 inches in the west and north and to more than 8 inches in the mountains of Connemara. The general rainfall, expressed as a percentage of the average, was as follows :—England and Wales, 85; Scotland, 86; Ireland, 81; British Isles, 86.

In London (Camden Square) the temperature exceeded 80° in the shade on ten consecutive days, from 6th to 17th. Mean temperature, 64°·6 or 2°·3 above the average. Duration of sunshine, 204·7 hours, and of rain, 37·7 hours. Evaporation, 2·78 inches.

RAINFALL TABLE FOR AUGUST, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875–1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Date.	No. of Days
Camden Square	*London*	2·39	2·37	— ·02	99	·75	28	11
Tenterden	*Kent*	3·52	3·52	+1·10	145	·95	28	13
Arundel (Patching)	*Sussex*	2·52	3·59	+1·07	142	·71	27	11
Fordingbridge (Oaklands)	*Hampshire*	2·76	2·90	+ ·14	105	·93	27	11
Oxford (Magdalen College)	*Oxfordshire*	2·44	2·90	+ ·46	119	·62	28	13
Wellingborough	*Northampn*	2·36	2·30	— ·06	97	·90	28	10
Bury St. Edmunds (Westley)	*Suffolk*	2·52	2·50	— ·02	99	·82	28	13
Geldeston [Beccles]	*Norfolk*	2·22	1·61	— ·61	73	·59	28	11
Polapit Tamar [Launceston]	*Devon*	3·17	2·61	— ·56	82	·58	27	13
Rousdon [Lyme Regis]	,,	2·84	4·10	+1·26	144	1·61	27	14
Ross (Birchlea)	*Herefordshr.*	2·90	2·03	— ·87	70	·49	27	14
Church Stretton	*Shropshire*	...	2·65	...	...	·81	19	10
Boston	*Lincoln*	2·39	2·58	+ ·19	108	·71	25	11
Worksop (Hodsock Priory)	*Nottingham*	2·55	2·25	— ·30	88	·81	28	14
Mickleover Manor	*Derbyshire*	2·80	2·04	— ·76	73	·64	27	10
Congleton (Buglawton Vic.)	*Cheshire*	3·52	3·39	— ·13	96	·62	26	17
Southport (Hesketh Park)	*Lancashire*	3·73	3·27	— ·46	88	·83	28	18
Wetherby (Ribston Hall)	*York, W.R.*	2·78	2·11	— ·67	76	·77	28	10
Hull (Pearson Park)	,, *E.R.*	3·05	2·50	— ·55	82	·75	28	15
Newcastle (Town Moor)	*North'land*	3·20	2·38	— ·82	74	·94	28	13
Borrowdale (Seathwaite)	*Cumberland*	11·47	6·95	—4·52	61	...	...	...
Cardiff (Ely)	*Glamorgan*	4·54	2·68	—1·86	59	·98	27	14
Haverfordwest	*Pembroke*	4·21	...	...	...	...	...	...
Aberystwyth (Gogerddan)	*Cardigan*	4·88	4·52	+ ·36	93	·90	25	14
Llandudno	*Carnarvon*	3·16	3·32	+ ·16	105	1·09	28	15
Cargen [Dumfries]	*Kirkcudbrt.*	4·23	3·45	— ·78	82	1·40	25	19
Marchmont House	*Berwick*	3·54	2·55	— ·99	72	·75	25	11
Girvan (Pinmore)	*Ayr*	4·54	3·21	—1·33	71	·60	26	24
Glasgow (Queen's Park)	*Renfrew*	3·62	2·49	—1·13	69	·70	25	15
Islay (Eallabus)	*Argyll*	4·49	4·61	+ ·12	103	·67	21	25
Mull (Quinish)	,,	5·00	6·21	+1·21	124	·87	25	27
Loch Dhu	*Perth*	6·70	3·20	—3·50	48	1·10	25	13
Dundee (Eastern Necropolis)	*Forfar*	3·34	2·44	— ·90	73	1·19	25	15
Braemar	*Aberdeen*	3·63	1·53	—2·10	42	·71	25	12
Aberdeen (Cranford)	,,	3·07	2·73	— ·34	89	1·32	25	16
Gordon Castle	*Moray*	3·29	2·25	—1·04	68	...	...	...
Drumnadrochit	*Inverness*	3·11	1·85	—1·26	59	·38	17	20
Fort William	,,	6·15	5·57	— ·58	91	·95	17	26
Loch Torridon (Bendamph)	*Ross*	6·61	9·10	+2·49	138	1·61	24	24
Dunrobin Castle	*Sutherland*	2·71	...	...	...	...	...	...
Glanmire (Lota Lodge)	*Cork*	3·83	3·27	— ·56	85	·94	18	13
Killarney (District Asylum)	*Kerry*	4·57	2·77	—1·80	61	·50	19	17
Waterford (Brook Lodge)	*Waterford*	3·73	4·41	+ ·68	118	1·34	18	13
Nenagh (Castle Lough)	*Tipperary*	4·04	3·10	— ·94	77	·56	31	21
Ennistymon House	*Clare*	5·01	3·34	—1·67	67	·81	31	17
Gorey (Courtown House)	*Wexford*	3·31	2·91	— ·40	88	·68	25	9
Abbey Leix (Blandsfort)	*Queen's Co.*	3·94	2·29	—1·65	58	·47	31	13
Dublin (Fitz William Square)	*Dublin*	3·08	2·29	— ·79	74	·43	25	16
Mullingar (Belvedere)	*Westmeath*	4·00	1·85	—2·15	46	·37	29	16
Crossmolina (Enniscoe)	*Mayo*	4·68	4·66	— ·02	100	·84	17	20
Cong (The Glebe)	,,	4·70	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	4·30	3·87	— ·43	90	·58	31	19
Seaforde	*Down*	3·64	2·98	— ·66	82	·96	25	14
Ballymena (Harryville)	*Antrim*	4·18	3·67	— ·51	88	·70	24	22
Omagh (Edenfel)	*Tyrone*	4·22	4·11	— ·11	97	1·05	24	18

SUPPLEMENTARY RAINFALL, AUGUST, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Sevenoaks, Speldhurst Close.	2·65	XI.	Lligwy	3·03
,,	Ramsgate	1·52	,,	Douglas, Isle of Man	3·63
,,	Hailsham	3·72	XII.	Stoneykirk, Ardwell House...	2·87
,,	Totland Bay, Aston House...	2·95	,,	Carsphairn, Shiel	5·20
,,	Stockbridge, Ashley..	3·15	,,	Langholm, Drove Road	3·98
,,	Grayshott	3·34	XIII.	Selkirk, The Hangingshaw..	2·27
,,	Upton Nervet	2·74	,,	North Berwick Reservoir	2·54
III.	Harrow Weald, Hill House...	2·85	,,	Edinburgh, Royal Observaty.	...
,,	Pitsford, Sedgebrook	2·08	XIV.	Biggar	2·93
,,	Woburn, Milton Bryant	3·03	,,	Maybole, Knockdon Farm ...	3·74
,,	Chatteris, The Priory	1·91	XV.	Shiskine	3·29
IV.	Elsenham, Gaunts End	2·48	,,	Ardgour House	8·67
,,	Rayleigh	1·92	,,	Oban	...
,,	Colchester, Hill Ho., Lexden	2·26	,,	Holy Loch, Ardnadam	4·54
,,	Aylsham, Rippon Hall	2·13	,,	Loch Venachar	3·30
,,	Swaffham	2·58	XVI.	Glenquey	2·60
V.	Bishops Cannings	3·02	,,	Loch Rannoch, Dall	2·20
,,	Weymouth	2·56	,,	Blair Atholl	...
,,	Ashburton, Druid House	4·17	,,	Coupar Angus	2·19
,,	Cullompton	3·49	,,	Montrose, Sunnyside Asylum.	2·17
,,	Lynmouth, Rock House	2·57	XVII.	Balmoral	1·35
,,	Okehampton, Oaklands	...	,,	Fyvie Castle	2·34
,,	Hartland Abbey	2·69	,,	Keith Station	3·03
,,	St. Austell, Trevarna	3·55	XVIII.	Rothiemurchus	...
,,	North Cadbury Rectory	3·57	,,	Loch Quoich, Loan	14·70
VI.	Clifton, Stoke Bishop	2·86	,,	Skye, Dunvegan	6·62
,,	Ledbury, Underdown	2·11	,,	Fortrose	2·07
,,	Shifnal, Hatton Grange	2·17	,,	Glencarron Lodge	7·89
,,	Droitwich	2·02	XIX.	Tongue Manse	7·42
,,	Blockley, Upton Wold	2·78	,,	Melvich	4·47
VII.	Grantham, Saltersford	2·72	,,	Loch More, Achfary	15·83
,,	Louth, Westgate	3·23	XX.	Dunmanway, The Rectory	3·88
,,	Bawtry, Hesley Hall	2·50	,,	Mitchelstown Castle	2·34
,,	Derby, Midland Railway	2·09	,,	Gearahameen	5·40
VIII.	Nantwich, Dorfold Hall	2·78	,,	Darrynane Abbey	3·90
,,	Bolton, Queen's Park	...	,,	Clonmel, Bruce Villa	2·65
,,	Lancaster, Strathspey	3·83	,,	Roscrea, Timoney Park	2·17
IX.	Langsett Moor, Up. Midhope	...	,,	Broadford, Hurdlestown	2·82
,,	West Witton	2·76	XXI.	Enniscorthy, Ballyhyland...	3·25
,,	Scarborough, Scalby	2·83	,,	Rathnew, Clonmannon	2·65
,,	Ingleby Greenhow	3·33	,,	Hacketstown Rectory	3·16
,,	Mickleton	3·30	,,	Ballycumber, Moorock Lodge	2·24
X.	Bellingham, High Green Manor	3·07	,,	Balbriggan, Ardgillan	2·33
,,	Ilderton, Lilburn Cottage	2·03	,,	Castle Forbes Gardens	3·48
,,	Keswick, The Bank	4·27	XXII.	Ballynahinch Castle	5·61
,,	Orton	4·39	,,	Woodlawn	2·92
XI.	Llanfrechfa Grange	3·53	,,	Westport House	4·19
,,	Treherbert, Tyn-y-waun	5·67	,,	Dugort, Slievemore Hotel	...
,,	Carmarthen, The Friary	3·00	XXIII.	Enniskillen, Portora	...
,,	Fishguard, Goodwick Station.	2·46	,,	Dartrey [Cootehill]	2·58
,,	Crickhowell, Tal-y-maes	3·00	,,	Warrenpoint, Manor House	2·45
,,	Birmingham WW., Tyrmynydd	3·96	,,	Belfast, Cave Hill Road	3·96
,,	Lake Vyrnwy	2·72	,,	Glenarm Castle	2·74
,,	Llangynhafal, Plas Drâw	3·64	,,	Londonderry, Creggan Res...	3·79
,,	Rhiwbryfdir	7·77	,,	Milford Manse	3·47
,,	Dolgelly, Bryntirion	4·94	,,	Killybegs	5·17

Climatological Table for the British Empire, March, 1919.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	56·5	2	26·0	23	47·4	34·5	35·9	...	100·0	24·0	3·62	21	6·9
Malta	75·2	9	44·0	20	64·2	52·7	...	83	133·0	44·0	1·56	7	0·4
Lagos	96·0	21	71·4	27	88·7	78·5	77·2	80	157·4	68·0	5·98	7	7·9
Cape Town	99·7	14	52·8	27	82·2	61·1	58·1	66	...	...	·13	1	3·2
Johannesburg	83·8	23	48·5	14	75·3	55·9	52·3	73	...	47·7	3·44	7	4·2
Mauritius	88·5	11	65·2	29	84·7	73·3	71·2	78	...	62·8	7·98	15	6·3
Bloemfontein	91·4	4	48·9	21*	82·9	55·3	52·6	58	..	...	2·60	8	4·9
Calcutta...	102·9	31	60·6	5	94·7	70·0	63·4	58	...	52·3	·51	1	2·2
Madras	94·9	31	66·4	10	88·9	72·0	70·4	74	159·2	69·6	1·96	2	1·3
Colombo, Ceylon ...	93·5	29	68·6	3	89·8	73·5	71·8	77	158·6	62·0	3·36	10	3·2
Hongkong	82·8	25	53·8	31	70·9	63·9	63·9	90	...	...	1·76	11	9·1
Sydney	88·5	20	54·8	22	77·9	63·0	59·5	67	148·3	49·9	5·29	13	4·4
Melbourne	94·2	3	42·0	25	70·6	54·3	51·6	67	146·8	36·9	6·48	15	6·5
Adelaide	94·7	25	48·5	17	77·2	56·8	51·0	54	152·9	35·0	·09	4	4·0
Perth	103·2	9	52·1	27	83·6	63·9	57·0	59	164·2	43·0	·61	3	3·5
Coolgardie	104·8	17	52·8	26	88·9	61·8	51·0	40	165·8	48·5	·91	1	3·4
Brisbane	99·4	5	62·0	16†	85·1	67·8	63·9	67	155·0	57·8	6·02	14	4·6
Hobart, Tasmania ..	83·4	29	37·0	25	66·8	51·6	46·7	61	140·5	29·8	5·86	13	6·8
Wellington	73·8	8	41·9	23	66·8	54·0	50·2	69	138·0	25·6	1·10	6	3·8
Jamaica, Kingston ...	90·3	1	64·9	21	86·7	69·3	67·2	76	...	...	1·35	3	3·5
Grenada	88·0	17	70·0	20	85·0	73·0	...	68	138·0	...	·64	6	2·5
Toronto	56 0	26	7·3	6	42·1	25·5	23·7	74	109·0	4·2	3·19	11	4·7
Fredericton	57·0	26	-8·0	16	39·9	20·2	23·1	71	...	...	3·82	13	5·4
St. John, N.B. ...	54·3	26	4·0	14	39·6	25·7	25·7	72	119·5	3·9	3·21	15	5·9
Victoria, B.C.	62·5	29	32·0	1	50·0	32·0	38·0	80	125·0	23·0	2·22	18	6·9

* and 24. † and 20.

COLOMBO, CEYLON.—Mean temp. 81°·6, or 0°·3 above, dew point 0°·7 below, and R ·78 in. below, averages. Mean hourly velocity of wind 3·6 miles. TS8 on 2 days. Prevailing direction of wind W.S.W.

HONGKONG.—Mean temp. 66°·7. Bright sunshine 80·5 hours. Mean hourly velocity of wind 13·5 miles.

Melbourne.—Mean temp. 2°·1 below, and R 4·28 in. below, averages; 3·55 in. of R fell on the 5th, the greatest fall for any one day in 64 years.

Adelaide.—Mean temp. 2°·9 below, and R ·96 in. below, averages; a cool month, only two having been cooler in the past 62 years.

Perth.—R ·12 in. below average.

Coolgardie.—Temp. 3°·9 above, and R ·18 in. above, averages.

Brisbane.—Temp. and R slightly above averages, the drought being finally broken.

Wellington.—Mean temp. 0°·2 above, and R 2·27 in. below, averages. Bright sunshine, 239·2 hours. One sunless day.

Symons's
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"BRITISH RAINFALL, 1918."

"British Rainfall, 1918," the fifty-eighth annual volume of the series, by H. R. Mill and M. de Carle S. Salter, is now completely in type, and should shortly be ready for issue.

Although compiled entirely since the end of 1918 the new volume deals with the observations made during that year, and was prepared practically under the same conditions as its four predecessors which were published during the war. A severe restriction of space was therefore inevitable, but the size of the volume is slightly larger than that for 1917, and no break of continuity in the series of tables and maps has been necessary.

The Annual Report of the Directors to the Trustees, and a statement by Mr. Francis Druce, Treasurer to the Endowment Fund, give an account of the reasons which have led to the transfer of the responsibility for the future conduct of the British Rainfall Organization to the Government. The transfer was carried out on July 24th, 1919, and on the same date the resignation of Dr. H. R. Mill from the directorship, as stated in this Magazine for August, took place. Mr. Salter, who had acted as Assistant Director since 1913, and as Joint-Director with Dr. Mill since 1918, has been appointed Superintendent in charge of the work of the Organization. Dr. Mill contributes an article on the Development of the British Rainfall Organization since 1910, when it first ceased to be a purely private institution, bringing up to date his article in *British Rainfall, 1909.* which dealt with the first fifty years of its history. He outlines some of the possible future advances which it is hoped may be realized under the new conditions.

A full abstract of Mr. Salter's recent paper on the Relation of Rainfall to Configuration is also given, setting out some generalizations resulting from the cartographical treatment of rainfall data by Dr. Mill during the last nineteen years.

The statistical basis for the study of the rainfall of 1918 consisted of 4998 records, or 87 fewer than were available for 1917. The diminution in the number of stations has, however, been set off

by an improvement in distribution. The number of records of rainfall duration published continues to increase, and complete monthly tables of this element are given for 61 stations.

The year was characterized by an unusual absence of heavy daily rainfalls, but detailed accounts are given of several violent and extremely local thunderstorms during the summer.

The volume is fully illustrated, including a portrait of Dr. H. R. Mill, and the usual coloured map showing the relation of the year's rainfall to the average, this being the thirteenth map of the kind published in successive years.

WIRELESS METEOROLOGICAL INFORMATION TO AND FROM SHIPS AT SEA.

By Lieut. H. G. Grant, R.N.,
Superintendent, Meteorological Department of the Admiralty.

The *London Gazette* of 15th August last, contains over the signature of the Hydrographer of the Navy an Admiralty Notice to Mariners (No. 1393 of 1919) in regard to wireless meteorological information to and from ships at sea. There is no change whatever in the general arrangements for collection, transmission, and issue of information outlined in the previous Notice (No. 880 of 1919), published in *The Times* on May 6th (see this Magazine, May, 1919, p. 37), which is superseded by the present Notice. There are, however, several material changes in the schedule of wireless stations.

The note previously appearing in regard to the British stations at Poldhu and Cleethorpes to the effect that these stations "would be started shortly" is now deleted, and the stations are given as working. The station at Washington now issues bulletins at two fixed hours of the day instead of only one. New weather-reporting stations are notified as established at Annapolis, U.S.A., and for the Mediterranean at Rinella.

The Notice contains the information that negotiations are in hand to extend and unify the system of collecting weather data by wireless from ships at sea all over the world, and at the same time to organize the free transmission of weather bulletins from a sufficient number of wireless stations to admit of ships being constantly supplied with reliable weather reports and forecasts wherever they may be.

The Notice further adds :—"It should be borne in mind that the needs of ships at sea in regard to information regarding the weather will march hand in hand with the requirements of aircraft. The importance of this service will, therefore, be constantly increasing, and its success or failure will largely depend upon the co-operation of ships at sea in providing the data without which accurate fore-

casting is impossible. The matter does not depend solely upon the efforts of the ships selected to furnish the data. The essence of success lies in rapidity in passing such data by wireless from the ship to the coast station, and thence to the central meteorological office. It follows, therefore, that all ships not taking an active part in supplying data should use the greatest care not to interfere with the transmission of the wireless messages to the shore.

"Earnest endeavours are being made to obtain international agreement as to the form of these weather bulletins and to the methods and times of transmission. It is hoped that the messages will eventually all be made in an international code at fixed times, so arranged that a ship with only one wireless operator will be able to read them. A similar scheme for time signals is being evolved."

The Naval Meteorological Service under the Hydrographic Department of the Admiralty issue the following Wireless Weather Bulletins, giving in plain language forecasts for specified areas for the information of ships at sea, namely :—

1. *Western and South-Western Seaboard of the British Isles* :—Embracing the Western and South-Western Seaboard of the British Isles, and including the Bristol Channel and Mouth of the English Channel ; also, when possible, the Bay of Biscay.

This Weather Bulletin is identified by the prefix, "Western."

(*a*.) Wireless Telegraph Weather Bulletin, giving forecast for the following 12 hours, issued to "All Ships" from Poldhu, at 0930 G.M.T. (9.30 a.m.), on 2,700 metres wave, based on observations taken at 0700 G.M.T. (7 a.m.).

(*b*.) Wireless Telegraph Weather Bulletin, giving forecast for the following 12 hours, issued to "All Ships" from Poldhu, at 2130 G.M.T. (9.30 p..m) on 2,700 metres wave, based on observations taken at 1800 G.M.T. (6 p.m.)

2. *North Sea, Eastern and South-Eastern Seaboard of British Isles* :—Embracing entire North Sea and also English Channel.

This Weather Bulletin is identified by the prefix "Eastern."

(*a*.) Wireless Telegraph Weather Bulletin, giving forecast for the following 12 hours, issued to "All Ships," from Cleethorpes, at 0500 G.M.T. (5 a.m.) on 3000 metres wave, based on observations taken at 0100 G.M.T. (1 a.m.).

(*b*.) Wireless Telegraph Weather Bulletin, giving forecast for the following 12 hours, issued to "All Ships," from Cleethorpes, at 1700 G.M.T. (5 p.m.) on 3,000 metres wave, based on observations taken at 1300 G.M.T. (1 p.m.).

By arrangement with the Admiralty these Bulletins are also published daily in the weather columns of *The Times*.

It is interesting to observe that somewhat similar messages which give both data for selected stations and forecasts in non-technical language for specified areas are prepared by the Weather Bureau of the United States and circulated from Arlington.

BRITISH ASSOCIATION AT BOURNEMOUTH.

At the Conference of Delegates of Scientific Societies, Lord Montague of Beaulieu, President, in the chair, Mr. M. de Carle S. Salter, Superintendent of the British Rainfall Organization, read a paper entitled, "The Exposure of Rain Gauges, "of which the following is a brief abstract :—

As the result of several series of experiments conducted under the direction of the late Mr. G. J. Symons the adoption of the Standard rain gauge, exposed at one foot above ground, has become general in this country. The diminution of catch in rain gauges exposed at greater heights above ground was long thought to be due to a variation in the fall at different elevations, but is now recognized as being caused by wind eddies preventing the rain from entering the funnel. Gauges sufficiently sheltered yield substantially indentical results at all elevations above ground. Far too little attention has been given to the provision of proper shelter from strong wind in placing rain gauges. In inland and naturally sheltered localities this precaution may usually be neglected with impunity, but in positions near the sea or at considerable altitudes, shelter, especially on the side of the prevailing wind, is necessary. In such positions the loss caused by elevating the gauge more than one foot above the ground is greater proportionally to the degree of exposure. It is greatly aggravated in the case of snow and still more so should the gauge be of the obsolete shallow-funnel type. Rain gauges should on no account be placed on sites where the land slopes downwards on the side of the prevailing wind, or near the top of a cliff or terrace. As a general rule the loss of catch in faultily exposed gauges occurs principally in the winter months, and, save in exceptional cases the loss in the summer half year may be safely ignored.

Whilst avoiding over exposure it is equally important to place a rain gauge so that no part of the rain shall be intercepted by objects too near the gauge, more particularly by trees or growing plants.

The existence of errors in rainfall records due to faulty exposure, is usually made apparent by the want of harmony with values at neighbouring stations observed when plotting rainfall maps. A large number of instances of want of harmony have been specially investigated, the gauges in nearly every case proving to be defective, either in construction or exposure. The degree of disparity which may be taken to indicate error decreases largely with the length of period dealt with, inconsistencies of 25 per cent. in a month's rainfall, not explained by the configuration, being sometimes due to variations in the actual fall, whilst in mapping the rainfall of a year, or the average of a series of years, a variation of 5 per cent. would probably indicate error.

On Thursday, September 11th, at Linden Hall, Bournemouth, a meteorological luncheon was held, Sir Napier Shaw in the chair. We hope to give an account of this in our next issue.

FLOOD WARNINGS IN NEW ZEALAND.

THE problem of flood prevention in New Zealand is dealt with in a recent report by the Dominion Meteorologist, Lt.-Col. D. C. Bates, to whom we are indebted for the following notes. The interference of civilization with natural conditions is not usually in the direction of lessening flood damage, clearing and drainage, causing the water to run off quickly, thus increasing the scouring of slopes and deposition of silt in the lower reaches. The effect is to raise the general level of the lower beds and aggravate flooding. The problem of prevention is one which appears only to be soluble as a national task, the reconciliation of conflicting interests being too difficult to achieve on any other lines and the report recommends strongly the organization of both prevention and warnings on a proper basis.

Attention is directed to the abnormal flooding which not infrequently occurs when the winter snows melt, these being entirely disproportionate to the actual amount of precipitation. Apart from snow the run-off is stated to be approximately 25 per cent. of the precipitation, a figure which we imagine must be applied only with a very generous margin of uncertainty. Experience in the British Isles shows us that the expression of the run-off as a percentage of the amount of precipitation is misleading, since quite apart from the very great variability at different seasons and under different conditions of soil and weather, recognized by Mr. Bates, it is practically certain that a much larger proportion of run-off occurs when the average rainfall is large than when it is small.

The prediction of floods may be attempted on (i.) the weather chart; (ii.) the records of rainfall in the river basins, and (iii.) the actual rise of the streams in their upper reaches. Owing to the known uncertainty, especially in respect to locality, in forecasting heavy rain, the first mentioned method is only applicable in a general manner. The second source of information is undoubtedly capable of development by provision of more observing stations and improving means of communicating records, but the actual rising of the river affords the most certain and striking means of forecast, not only for the time but for the height of an inundation.

The report recommends the closer observation of rainfall, the establishment of flood gauges, and the formation of a Committee of Safety or Rivers Board charged with the organization and administration of flood warnings in consultation with the Dominion Meteorological Service, the Public Works and Railway Departments.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

EARLY SNOW.

On the morning of September 20th, we had a fall of snow, almost a covering. The earliest I have hitherto recorded snow at Sunderland, since 1857, inclusive, was October 4th, which was in 1867. Since the 20th there have been some warm days, the thermometer reaching 67° on the 25th. T. W BACKHOUSE.

West Hendon House, Sunderland, September 27th, 1919.

On looking out at 8 a.m. (Summer Time), September 20th, I could scarcely believe my eyes on seeing the Black Mountains glistening with snow under a brilliant sun. On the previous day I had expected to hear of the first snow on the Scottish mountains with the cold north-westerly type of weather then prevalent, but I was not prepared to see snow actually lying in Herefordshire. The snow-level was about 1,300 feet; it had all gone by 11 a.m. (though probably not on the northern slopes, invisible from here). The Clee Hills round Ludlow, had a covering of two to three inches, and the Ludlow hounds meeting at the foot of the hills had to be stopped in a run and taken off to the lower ground owing to the snow balling in the horses' feet; the snow lasted here till about mid-day. In the early morning there was a slight trace lying right down in the Teme Valley, not 300 feet above sea-level. We had a September snow last year, on the 29th, which I never expected to see equalled, much less eclipsed by nine days, and that within a year. On that occasion the cold was caused by the passage of a depression to our south and Sunday, September 29th, 1918, had a maximum temperature of only 45°, with a bitter rain from east and north-east. After 3 p.m. (G.M.T.) temperature was 40° or below, and above 800 feet snow was mingled with the rain. The Black Mountains were covered quite six inches deep, and remained pure white for twenty-four hours above 2,800 feet, while drifts remained for a week. There was no further snow lying on them till within a week of Christmas! September, 1919, closed with severe frost, the exposed thermometer 4 feet above ground on the morning of the 29th, registering a minimum of 21°, the lowest September reading recorded in 33 years' observations. Walnuts were frozen on the trees and completely destroyed, being subsequently turned into a dry, black, crinkled pulp.

Kentchurch Rectory, Hereford, September 30th, 1919. R. P. DANSEY.

A RECORD RAINFALL FOR GUERNSEY, 1894-1919.

THE depression of September 2nd and 3rd gave the biggest rainfall at this station in the twenty-six years, 1894-1919.

Rain set in with a south wind at 2 p.m., on September 2nd, and after falling spasmodically during the afternoon and evening (·67 in. fell in the first three hours) the wind veered to north, and a steady downpour followed. At 9 a.m. on the 3rd, the total for the seventeen hours was just 2·50 in.; or ·08 in. in excess of my previous heaviest daily fall, viz., 2·42 in., on October 2nd, 1904.

In the twenty-six years 2 inches of rain as a daily fall has been recorded four times only at this Channel Island station.

As regards this week's rainfall, the heaviest rain fell undoubtedly with the north wind and ceased gradually and ultimately altogether with a backing of the wind to north-west and west.

"*Les Blanches*," *Guernsey, September 5th, 1919.* BASIL T. ROWSWELL.

THE CLIMATE OF MESOPOTAMIA.

THE following extracts from letters from a friend in Mesopotamia may be of interest to readers of this Magazine.

From Corpl. R. J. Smith, R.E., April 6th, 1918 :—

> "....I will now give you a little idea of the meteorological conditions out here. There is an enormous difference between summer and winter temperatures. We have been experiencing a very cold and wet winter, after having had no rain for nearly nine months. The hot weather is late in starting this year, but it will not be many days now before we need topees and spine-pads. Our coldest day this winter was in last December, when 14° of frost were registered, and the hottest last summer was 124°·8 in shade. In tents it goes up to at least 135°. The buttons on one's tunic get too hot to touch the same with one's rifle and all metal objects. The glare is terrible, and one needs dark blue glasses; further protection from the sun is given by spine-pads, and helmet shades (a flap which comes over the nape of the neck) . . . In the winter we feel the cold tremendously, especially as we have to live in tents (more or less rain-proof), and have no fires, not even a charcoal brazier. This [Mesopotamia] is a healthy climate in the winter, better than India, I think . . . ."

From Corpl. R. J. Smith, R.E., July 31st, 1918 :—

> "The highest shade temperature ever officially recorded in Baghdad is 124°·8 F., in July, 1917, and the coldest, 18°·6 F., a few years ago. Last winter, at Baqubah, we often had 12° of frost. As regards rainfall (in Mesopotamia) none has ever been known during the months June to September, and the total per year is 6·89 in., which falls on an average of sixteen rain-days. In the winter the rain is like what one experiences in England, accompanied by very high winds and dust storms, when the rain ceases, which is very uncomfortable during camp life, as the dust penetrates everywhere. The mean daily maximum shade temperature for this month (July), is 109°·2, and minimum ditto 79°·7 . . . . August is the worst month, so have plenty of hot weather to come. I am writing this in a temperature of 112° F.

Tower Park, Moretonhampstead. D. W. HORNER, F.R.Met.Soc.

DEATH BY LIGHTNING—AN UNUSUAL PHENOMENON.

On Sunday, the 14th September, 1919, about 7.40 p.m., I was called to see a man who was struck down by lightning at Finsbury Park, London, N. He was accompanied by his wife and his wife's sister. At the inquest his wife stated that with a particularly vivid flash she was thrown down and rendered unconscious for a short time. When she recovered she found her husband standing erect with his coat on fire, and she tried to extinguish the flames. With the next peal of thunder he expired. A man who was running to his assistance told me he saw the man falling backwards against the iron fencing near. There were rows of elm trees at the spot where he was at the time.

The coat was severely burnt from the collar down to the bottom, nearly completely severing the coat in two. The back of the waistcoat was likewise badly burnt, and his shirt less so. The edges of the braces were burnt at one place on each; trousers at upper part of back slightly. The hair of the back of the head was singed. There was a burn on the back of the neck. The space between the middle of both scapulæ was extensively burnt to the first degree, the mid-dorsal region slightly, but on both sides severely. At the right lower lumbar region was the largest burn. At various spots there were slight points of burns (punctures). Generally speaking the burns on the *right* side of the back were all worse than those on the left. He was evidently struck from the right side of his back.

From the right shoulder and across the chest and down to the lower of the front of the abdomen impressions of branches and leaves were clearly imprinted on the skin, showing like an X-ray plate how certain rays of light were impeded by the branches and foliage, whilst others made the contour of these. There were two distinct branches with leaves, one occupying the space between the right iliac crest to near the ensiform cartilage and the other proceeding down on the left side from the stomach to the left iliac crest. To my mind it would appear as if these were implanted while the man was falling back with a flash coming over the right shoulder.

A. G. NEWELL, M.D., D.P.H.

Harringay, N. 8, September 21st, 1919.

[The production of a pattern resembling foliage is very curious, and at first sight, considering the great length of the source of light, it seems impossible to suppose the pattern to have been formed as a shadow. It may be, however, that the particular flash was approaching the tree in such a way that the man would have seen it end-on, and in that position sharp shadows would have been formed.—Ed., *S.M.M.*]

WIND IN RELATION TO TIDE.

It would be interesting to know the opinions and experiences of your readers as regards the change in direction or force of the wind in relation to the change of tide. It is common to find that among fishermen the belief is held that the tide has a distinct influence on the wind, and although the theory is usually discredited among meteorologists, it is certainly upheld to a great extent by my own modest experiences on this coast. Of course, there are many occasions when there is nothing in common between wind and tide, and perhaps the other occasions are mere coincidences, although they seem to occur too often to be classed as such. The change of the time of the turn of the tide from day to day naturally increases the possibility of a change in the force or direction of the wind coinciding with it. In the Bristol Channel, the tides of course run with great strength, and it is necessary to be on the sea to observe the influence on the wind. I am frequently out fishing at all times of the year and in conversation with the local fishermen, so have had fair opportunities of studying the subject.

The general direction of this coast runs E. to W., and so faces at right-angles to the flow of tide in the Channel, and there is a tendency for winds to group themselves round E. and W. With easterly winds, if there is some strength in them, there is a tendency to freshen as soon as the ebb-tide sets down, and to become lighter when the flood makes up, or as they say here, "the flood runs the wind off." When there are only light easterly winds they usually die away in the afternoon, "the sun eats the wind up," to quote a local saying again, or back N.W. at the change of tide, either ebb or flood. A very common wind here is W.N.W. to N.W. during the summer, in fact, it is on an average the most prevalent wind during that season. It gradually freshens to a fresh or strong breeze, until late afternoon, when it begins to fall off, and is known locally as a "sun-breeze," and is, in fact, a typical sea-breeze. The tide does not seem to make much difference in its strength, except that it usually freshens somewhat on the ebb. Another rather similar wind frequently occurs, when the true wind is S.W. and light in force, but on these occasions it is more northerly, and causes fog to form on the headlands. This wind nearly always seems to coincide with a change of tide, whether ebb or flood seems immaterial. All the above may be taken as occurring in "fine" weather, but when depressions are passing the effect of the tide is, as a rule, not so marked, of course, as there is a more general flow of air. However, I have frequently experienced sudden shifts of wind from S.W. to N.W. during bad weather, when the tide begins to flow. These squalls are sometimes very fierce, but usually fall off in strength after some time.

These are a few cases where very often there really does seem to be relationship between the tide and wind. It is, however, a complex subject, and doubtless varies on different parts of the coast.

Minehead, Somerset, September 15th, 1919. T. F. TWIST.

METEOROLOGICAL NEWS AND NOTES.

METEOROLOGICAL OFFICE APPOINTMENTS. The following appointments on the staff of the Meteorological Office have been notified. MR. R. G. K. LEMPFERT, M.A., C.B.E., late Superintendent of the Forecast Division, to be Assistant Director for general oversight of Observatories and Stations contributing observations to the Office as from September 1st, 1919. LT.-COL. E. GOLD, D.S.O., F.R.S., lately in command of the Overseas Contingent of the Meteorological Section of the Royal Engineers, to be Assistant Director in charge of Forecasting, as from September 1st, 1919. CAPT. D. BRUNT, M.A., to be Superintendent of Meteorological work for Army Services.

SIR RICHARD GLAZEBROOK, C.B., F.R.S., retired from the directorship of the National Physical Laboratory on September 18th, after twenty years' service, during which time the work and scope of the laboratory have been developed in an extraordinary manner. Professor J. E. Petavel, D.Sc., F.R.S., of Manchester University has been appointed as the new Director.

MEETINGS AT THE METEOROLOGICAL OFFICE for the discussion of contributions to current meteorology in Colonial and Foreign Journals will be resumed in November. The days arranged are Mondays, November 3rd and 17th, December 1st and 15th, 1919, and January 5th and 19th, February 2nd and 16th and March 1st, 15th and 22nd, 1920. The Director will be glad if Observers and others interested in Meteorology will favour him with their presence and take part in the discussions.

THE BRITISH DOMINIONS Meteorological delegates in the course of the recent Conference in London visited the headquarters of the British Rainfall Organization at 62, Camden Square, on September 26th. An exhibit of rainfall maps showing all branches of cartographical research on the distribution of rainfall was arranged.

FROSTS occurred on five days in September at Bristol where the shade temperature range for the month was 56°·3. At Camden Square the shade minimum on the 29th was 32°·2 being 0°·8 lower than the previous lowest temperature in September during 62 years.

SOUTH TEXAS experienced a tropical storm of unusual violence on September 14th. A Reuter New York message gives the fatalities in Corpus Christi and neighbouring localities at 120 and estimates the damage to property at about £2,000,000, while the Central News Washington correspondent says that approximately 30,000 people are homeless.

NOTES ON THE CLIMATE OF MESOPOTAMIA.

By C. H. E. Ridpath.

(*Continued from page* 91.)

During the summer dust-devils may be seen every day. Their diameter at the base is anything up to fifty yards. They travel with the wind and possess plenty of energy and lifting power. They extend many hundred feet into the air. A pilot in our squadron happened once to fly over the top of a dust devil. He was not lifted but fell 1,000 feet so quickly that the machine barely stood the strain when it suddenly encountered denser air again.

Dust storms, of course, take place on a much larger scale. It is noticeable sometimes how a cool wind will suddenly replace a hot wind in the opposite direction. During such a storm the dust particles will charge up wireless aerials to such an extent that the aerial, which, of course, is insulated from earth, will at times yield a spark, over a half-inch gap to earth, of a high enough frequency to cause a musical note. Such storms stop all wireless communication, but in any case atmospherics are bad the whole summer.

During the hot days if one is not lucky enough to have ice, porous pots or "chatties" give cool water. I often found 20° difference between air temperature and that of water in these vessels. They are a happy hunting ground, however, for mosquito larvæ. Water left out all day in non-porous vessels becomes scalding.

The adaptability of the human system is wonderfully exemplified when one considers that it can retain a temperature not far from the normal 98°·6 in an atmosphere of 120° and over. If perspiration stops there is immediate danger of heat stroke. It must be remembered that although a Stevenson screen may only register, say 120°, temperatures in tents may reach 125° and 130°; I have heard of higher figures, but doubt their accuracy.

In winter the prevailing winds are north-west and also points between south-east and south-west. The former wind brings fine weather, sometimes with very cold nights, but the latter brings thunderstorms and wet weather. Atmospherics are almost totally absent with the former wind, but reappear directly a change to the south takes place. I can best describe the winter by saying one provides oneself with clothing similar to that for an English winter. In December, 1917, a minimum of 16° was recorded at Samarra on the Tigris, eighty miles north of Baghdad. It is really an excellent climate in winter.

Rain is made to appear worse than it is owing to the fact that the soil is entirely composed of alluvial mud, one does not see much sand. This mud is, of course, baked hard in summer, except where there is traffic, when it turns into several inches of very fine light dust providing a good nucleus for dust devils and other abominations. A few hours' rain creates mud of a very tenacious quality sufficient to stop all motor traffic. Operations in winter were some-

times seriously handicapped by the weather, for at times communications from railhead were 150 miles long.

Thunderstorms of a fairly violent character take place the whole winter, but present no unusual features. On the average, winds do not attain abnormal force. In judging the elements when one is under canvas, great care has to be taken not to over-estimate. When a tent that contains all one's worldly possessions, is making a noise like stage thunder and exuding water at every pore at 2 a.m. with every sign of imminent collapse, one may be forgiven a little exaggeration!

I was once afforded an excellent example of the relation between atmospheric electricity and rainfall. I happened to be experimenting in a receiving station at the base of an eighty foot wireless mast near Hit, on the Euphrates. Quite suddenly, through the telephones, I heard the aerial start to charge up at a very rapid rate accompanied by the usual hissing sounds of brush discharges; in a few seconds very heavy rain indeed started. The storm lasted three or four minutes, but was so intense that one could only see a few yards away. I would not like to estimate the rain that fell in those four minutes, but I do know that destructive torrents appeared like magic and rushed through the camps doing a lot of damage. This storm did not start gradually but at once. Would it not be possible that the charging up of the aerial was due to a large volume of air being driven down under the first rush of the rain? Coming from a height this air would be at a higher potential than that of earth. This rain was unaccompanied by thunder, lightning or wind. At other times I have noticed similar but less intense phenomena. As soon as the rain starts the charging up of the aerial ceases, the aerial insulation from earth is of course, unimpaired by rain.

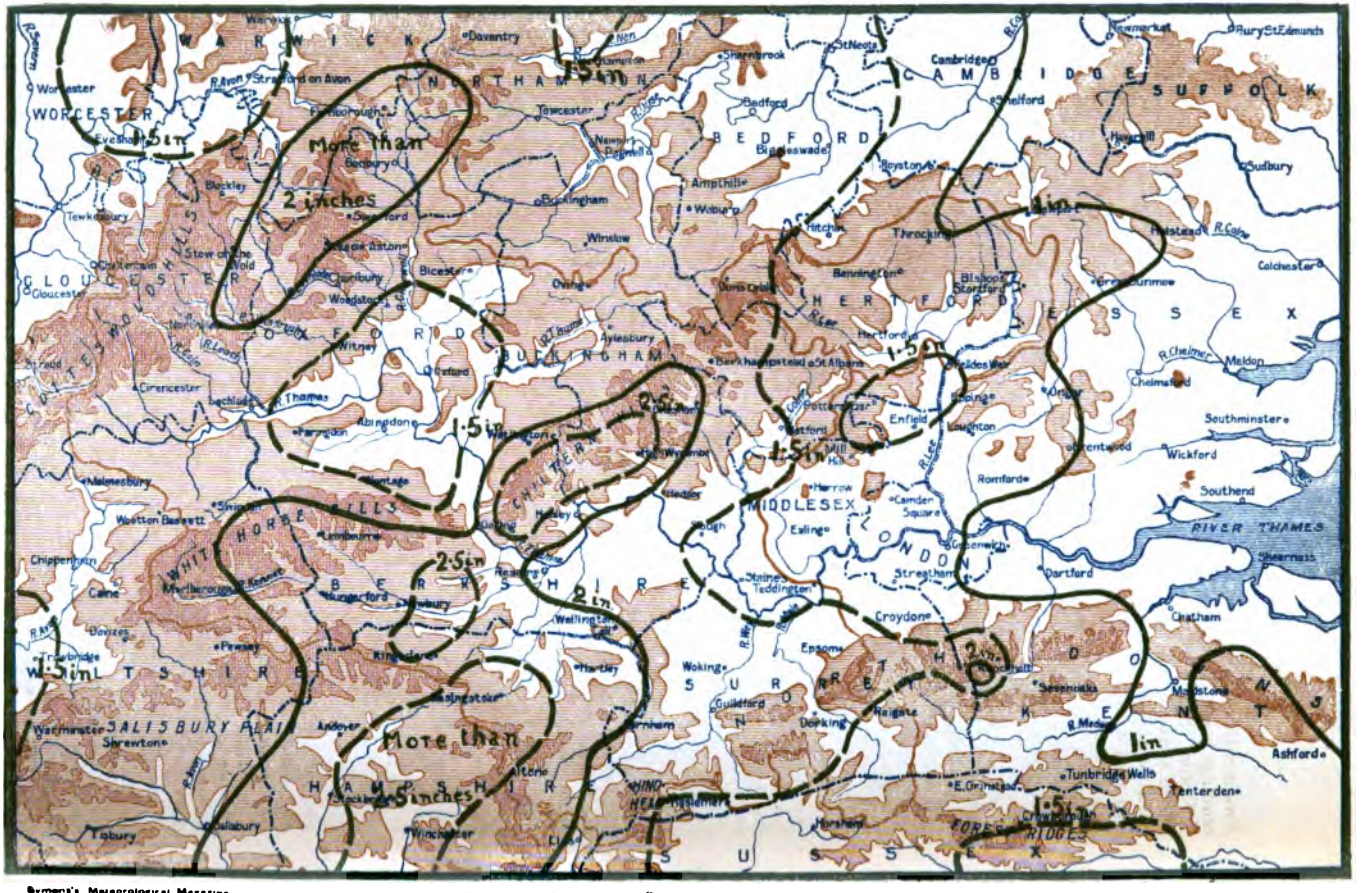
In spite of several storms and the fact that our eighty foot iron masts were the tallest of neighbouring objects, we never had one struck. This fact confirms the view that the function of a lightning conductor is to "tap off" high potential atmosphere at an altitude and relieve a tension that otherwise might bring about an actual discharge.

The Turks have had this country of wonderful possibilities for close on five hundred years and have done everything retrogressive: yet the land cries out for cultivation. After the first rains of autumn, barren desert yields grass, which in places becomes luxuriant by the next spring, only to wither and disappear once more with the return of the heat. Remains of great canals built by the ancients can still be seen and speculation is interesting on the amount of cultivation and its effect on the climate in those far-off days.

Mesopotamia was once a land of greatness and abundance; under Turkey the land was barren; under a wise and enterprising administration there are, indeed, great possibilities.

ERRATUM.—In the first part of this article the date 1918 should read 1917. and 1919 should read 1918.—C. H. E. Ridpath.

THAMES VALLEY RAINFALL SEPTEMBER 1919



Symons's Meteorological Magazine

Watershed of River Thames above Teddington, and River Lea above Tottenham Weir

Isohyetals

WEATHER OF SEPTEMBER.

THE month was distinguished by great fluctuations in temperature, some daily readings being unusually high for the time of year, and others equally low.

During the opening days the weather was influenced by a cyclonic system, which skirted our Atlantic seaboard, the winds being mainly from S. or S.W., with mild changeable conditions, and heavy rain on the 1st, in many western and northern districts. As the disturbance passed away the wind drew into W., and over a large portion of England the type of weather became anticyclonic. With an abundance of bright sunshine the thermometer rose steadily to a high level, the maximum shade readings on the 11th being above 85° at many English stations. At Raunds (Northants) the thermometer reached 90°, and in most parts of the country the day was hotter than any in the three summer months, June to August. On the 12th, when a new anticyclone spread in from the Atlantic, the wind shifted to N. and N.E., and a rapid fall of temperature occurred. In many places the change in twenty-four hours amounted to at least 20°, and at Nottingham to 28°, the shade maxima on the 11th and 12th being respectively 85° and 57°. Sharp frost occurred in Scotland on the nights of the 13th and 14th, the sheltered thermometer falling to a minimum of 27° at Balmoral and West Linton.

With the continued extension of the Atlantic high-pressure system, the polar current gradually died away, and on the 17th and 18th, the thermometer exceeded 70° in many of the English districts. A well marked depression (secondary to a larger disturbance over Scandinavia) skirted the north of Scotland on the 18th, and in its rear a fresh N. wind sprang up over the whole of the United Kingdom. Another rapid fall of temperature consequently took place, the maximum readings on the 19th and 20th being below 55° in most places, and below 50° at many northern stations. Sharp ground frosts occurred on the night of the 19th, the exposed thermometer sinking to 17° at Rounton (N. Yorks) and to 22° at Crathes, Durham, Worksop and Wisley. Snow fell about this time over a large portion of North Britain, and sleet or hail in many southern districts. During a spell of westerly winds, which prevailed between the 24th and 27th, the air again became much milder, and on the 25th most places experienced a shade maximum temperature well above 65°. A subsequent veering of the wind to the N.W. brought about a fresh reduction in temperature, and on the three nights, 27th to 29th, sharp frost was general. On the surface of the grass the minimum readings about this time were as low as 15° at Rhayader, 17° at West Linton, and 19° at Greenwich and Richmond.

Thunderstorms occurred locally over the southern half of England on the 6th and again on the 13th or 14th, and in the north of England and the south of Scotland on the 11th or 12th. Bright sunshine was fairly abundant.

The rainfall of the month was light over the southern and central areas of Great Britain, but increased towards the north, and in the Western Highlands was in excess of the average. It varied little from the average over Ireland. Less than an inch fell over the Thames Estuary, parts of East Anglia and the south-east coast, and less than 2 inches along nearly the whole of the east coast and in scattered areas in the south and Midlands. In the Pennines, the Welsh mountains, and over the greater part of the west of Scotland, the fall reached 5 inches. It exceeded 10 inches in Merionethshire, the English Lake District and over a considerable part of Inverness-shire. Between 2 and 4 inches fell over nearly the whole of Ireland, but more than 6 inches was recorded in elevated areas in the west and north. Nearly 10 inches fell in the mountains of Connemara. The general rainfall expressed as a percentage of the average, was :—England and Wales, 78; Scotland, 112; Ireland, 97; British Isles, 94.

In London (Camden Square) fine, warm weather prevailed in the early part. Shade temperature exceeded 70° on each of the first 13 days, and exceeded 80° on 4 days. A period of showery and cool weather followed, and on the 29th the shade minimum fell to 32°·2. Duration of rain. 14·4 hours. Evaporation, 1·53 inches.

RAINFALL TABLE FOR SEPTEMBER, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875–1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·00	1·29	— ·71	64	·51	14	10
Tenterden	*Kent*	2·25	1·35	— ·90	60	·53	22	8
Arundel (Patching)	*Sussex*	2·58	1·55	—1·03	60	·68	22	7
Fordingbridge (Oaklands)	*Hampshire*	2·39	1·61	— ·78	67	·80	2	12
Oxford (Magdalen College)	*Oxfordshire*	1·98	1·23	— ·75	62	·35	2	12
Wellingborough	*Northampn*	2·13	1·44	— ·69	68	·66	6	9
Bury St. Edmunds (Westley)	*Suffolk*	2·18	·59	—1·59	27	·20	22	9
Geldeston [Beccles]	*Norfolk*	2·13	·54	—1·59	25	·16	19	6
Polapit Tamar [Launceston]	*Devon*	3·11	1·82	—1·29	59	·39	19	13
Rousdon [Lyme Regis]	,,	2·69	1·54	—1·15	57	·42	4	11
Ross (Birchlea)	*Herefordshr.*	2·39	1·42	— ·97	59	·37	2	15
Church Stretton	*Shropshire*	2·40	·00		100	·89	12	9
Boston	*Lincoln*	2·07	1·52	— ·55	73	·96	5	10
Worksop (Hodsock Priory)	*Nottingham*	1·84	1·86	+ ·02	101	·69	13	14
Mickleover Manor	*Derbyshire*	2·11	1·78	— ·33	84	·58	22	13
Congleton (Buglawton Vic.)	*Cheshire*	2·67	2·68	+ ·01	100	·64	22	18
Southport (Hesketh Park)	*Lancashire*	3·09	2·35	— ·74	76	·64	1	17
Wetherby (Ribston Hall)	*York, W.R.*	2·11	1·02	—1·09	48	·30	1	6
Hull (Pearson Park)	,, *E.R.*	2·05	1·40	— ·65	68	·47	13	13
Newcastle (Town Moor)	*North'land*	2·00	1·05	— ·95	52	·33	1	11
Borrowdale (Seathwaite)	*Cumberland*	11·28	14·65	+3·37	130	...	...	...
Cardiff (Ely)	*Glamorgan*	3·61	2·64	— ·97	73	1·20	22	17
Haverfordwest	*Pembroke*	3·91	2·38	—1·53	61	·48	22	17
Aberystwyth (Gogerddan)	*Cardigan*	3·89	3·63	— ·26	91	1·06	22	16
Llandudno	*Carnarvon*	2·50	1·91	— ·59	76	·56	22	17
Cargen [Dumfries]	*Kirkcudbrt.*	3·34	3·60	+ ·26	108	·75	29	19
Marchmont House	*Berwick*	2·67	1·53	—1·14	57	·41	12	14
Girvan (Pinmore)	*Ayr*	4·30	4·61	+ ·31	107	·78	12	18
Glasgow (Queen's Park)	*Renfrew*	2·99	2·42	— ·57	81	·46	4	18
Islay (Eallabus)	*Argyll*	4·49	5·00	+ ·51	111	·84	25	25
Mull (Quinish)	,,	5·20	7·50	+2·30	144	·91	21	25
Loch Dhu	*Perth*	6·22	6·90	+ ·68	111	1·10	25	19
Dundee (Eastern Necropolis)	*Forfar*	2·34	1·18	—1·16	77	·31	1	15
Braemar	*Aberdeen*	2·73	2·73		100	·57	19	17
Aberdeen (Cranford)	,,	2·69	2·61	— ·08	97	·66	19	14
Gordon Castle	*Moray*	2·58	3·27	+ ·69	127	...	...	...
Drumnadrochit	*Inverness*	2·94	2·58	— ·36	88	·93	22	21
Fort William	,,	6·66	7·90	+1·24	119	1·60	25	25
Loch Torridon (Bendamph)	*Ross*	7·28	11·20	+3·92	154	2·22	25	23
Dunrobin Castle	*Sutherland*	2·51	2·85	+ ·34	114	·53	22	16
Glanmire (Lota Lodge)	*Cork*	3·20	2·01	—1·19	63	·40	30	14
Killarney (District Asylum)	*Kerry*	3·79	3·13	— ·66	83	1·19	30	19
Waterford (Brook Lodge)	*Waterford*	3·19	2·14	—1·05	67	·70	30	10
Nenagh (Castle Lough)	*Tipperary*	3·16	3·27	+ ·11	104	·88	22	19
Ennistymon House	*Clare*	4·22	5·75	+1·53	136	1·05	22	20
Gorey (Courtown House)	*Wexford*	2·78	2·68	— ·10	96	·76	3	14
Abbey Leix (Blandsfort)	*Queen's Co.*	2·93	2·22	— ·71	76	·82	22	14
Dublin (FitzWilliam Square)	*Dublin*	2·06	2·00	— ·06	97	·47	22	16
Mullingar (Belvedere)	*Westmeath*	3·02	...	...	...	...	...	...
Crossmolina (Enniscoe)	*Mayo*	4·42	4·45	+ ·03	101	·84	3	21
Cong (The Glebe)	,,	4·05	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	3·65	3·95	+ ·30	108	·62	3	21
Seaforde	*Down*	3·25	2·92	— ·33	90	1·16	4	19
Ballymena (Harryville)	*Antrim*	3·43	3·44	+ ·01	100	·35	30	19
Omagh (Edenfel)	*Tyrone*	3·39	4·19	+ ·80	124	·45	30	23

SUPPLEMENTARY RAINFALL, SEPTEMBER, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Sevenoaks, Speldhurst Close.	1·37	XI.	Lligwy	3·72
,,	Ramsgate	·90	,,	Douglas, Isle of Man	...
,,	Hailsham	1·16	XII.	Stoneykirk, Ardwell House...	2·84
,,	Totland Bay, Aston House...	1·44	,,	Carsphairn, Shiel	5·70
,,	Stockbridge, Ashley..	2·45	,,	Langholm, Drove Road	6·11
,,	Grayshott	1·62	XIII.	Selkirk, The Hangingshaw..	1·97
,,	Upton Nervet	3·24	,,	North Berwick Reservoir	2·57
III.	Harrow Weald, Hill House...	1·36	,,	Edinburgh, Royal Observaty.	2·23
,,	Pitsford, Sedgebrook	1·41	XIV.	Biggar	3·31
,,	Woburn, Milton Bryant	2·19	,,	Maybole, Knockdon Farm ...	4·42
,,	Chatteris, The Priory	1·72	XV.	Shiskine	3·77
IV.	Elsenham, Gaunts End	1·09	,,	Ardgour House	12·55
,,	Rayleigh	·55	,,	Oban	5·57
,,	Colchester, Hill Ho., Lexden	·71	,,	Holy Loch, Ardnadam	6·44
,,	Aylsham, Rippon Hall	·95	,,	Loch Venachar	4·60
,,	Swaffham	1·00	XVI.	Glenquey	6·50
V.	Bishops Cannings	1·83	,,	Loch Rannoch, Dall	3·10
,,	Weymouth	1·31	,,	Blair Atholl	...
,,	Ashburton, Druid House	3·07	,,	Coupar Angus	·96
,,	Cullompton	...	,,	Montrose, Sunnyside Asylum.	1·27
,,	Lynmouth, Rock House	2·08	XVII.	Balmoral	3·50
,,	Okehampton, Oaklands	...	,,	Fyvie Castle	5·57
,,	Hartland Abbey	1·57	,,	Keith Station	4·40
,,	St. Austell, Trevarna	2·84	XVIII.	Rothiemurchus	...
,,	North Cadbury Rectory	1·62	,,	Loch Quoich, Loan	....
VI.	Clifton, Stoke Bishop	1·61	,,	Skye, Dunvegan	8·59
,,	Ledbury, Underdown	1·30	,,	Fortrose	2·40
,,	Shifnal, Hatton Grange	1·72	,,	Glencarron Lodge	9·53
,,	Droitwich	1·60	XIX.	Tongue Manse	4·77
,,	Blockley, Upton Wold	1·80	,,	Melvich	2·67
VII.	Grantham, Saltersford	1·78	,,	Loch More, Achfary	9·41
,,	Louth, Westgate	1·93	XX.	Dunmanway, The Rectory	3·63
,,	Bawtry, Hesley Hall	1·52	,,	Mitchelstown Castle	2·31
,,	Derby, Midland Railway	1·60	,,	Gearahameen	7·50
VIII.	Nantwich, Dorfold Hall	2·45	,,	Darrynane Abbey	3·20
,,	Bolton, Queen's Park	2·22	,,	Clonmel, Bruce Villa	2·03
,,	Lancaster, Strathspey	2·59	,,	Roscrea, Timoney Park	2·00
IX.	Langsett Moor, Up. Midhope	...	,,	Broadford, Hurdlestown	4·19
,,	West Witton	·90	XXI.	Enniscorthy, Ballyhyland...	2·69
,,	Scarborough, Scalby	1·46	,,	Rathnew, Clonmannon	2·50
,,	Ingleby Greenhow	...	,,	Hacketstown Rectory	3·17
,,	Mickleton	2·20	,,	Ballycumber, Moorock Lodge	2·21
X.	Bellingham, High Green Manor	2·22	,,	Balbriggan, Ardgillan	1·99
,,	Ilderton, Lilburn Cottage	1·30	,,	Castle Forbes Gardens	3·49
,,	Keswick, The Bank	4·68	XXII.	Ballynahinch Castle	5·96
,,	Orton	3·70	,,	Woodlawn	4·43
XI.	Llanfrechfa Grange	2·33	,,	Westport House	3·94
,,	Treherbert, Tyn-y-waun	4·90	,,	Dugort, Slievemore Hotel	...
,,	Carmarthen, The Friary	2·53	XXIII.	Enniskillen, Portora	4·01
,,	Fishguard, Goodwick Station.	2·43	,,	Dartrey [Cootehill]	3·42
,,	Crickhowell, Tal-y-maes	2·00	,,	Warrenpoint, Manor House	2·62
,,	Birmingham WW., Tyrmynydd	2·66	,,	Belfast, Cave Hill Road	4·01
,,	Lake Vyrnwy	2·70	,,	Glenarm Castle	3·18
,,	Llangynhafal, Plas Drâw	2·46	,,	Londonderry, Creggan Res...	3·37
,,	Rhiwbryfdir	10·01	,,	Milford Manse	3·38
,,	Dolgelly, Bryntirion	6·94	,,	Killybegs	6·44

Climatological Table for the British Empire, April, 1919.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, CamdenSquare	71·0	19	27·4	3	55·1	38·1	39·6	80	119·7	25·7	3·93	18	7·3
Malta	84·2	5	51·0	27	65·9	55·4	...	82	135·0	...	·84	3	5·0
Lagos	99·0	9	72·0	9	88·1	73·4	75·1	76	158·0	68·0	3·96	11	4·9
Cape Town	94·9	18	50·1	20	73·5	57·6	57·1	77	...	...	1·71	8	3·8
Johannesburg	82·0	1	40·1	22	72·6	51·4	48·8	70	...	41·8	1·73	8	2·8
Mauritius	84·4	6	62·2	16	81·3	71·0	67·3	76	...	56·5	2·96	26	6·3
Bloemfontein	84·7	14	42·2	22	76·9	50·9	50·6	66	..	...	1·28	9	2·3
Calcutta...	103·0	13	66·6	9	96·1	75·3	71·0	67	...	63·1	4·02	4	3·5
Bombay	91·5	27	74·5	5	89·0	76·9	73·2	75	132·3	68·0	·00	0	1·3
Madras	98·3	23	73·7	5	93·6	78·7	75·0	75	163·6	71·3	·00	0	2·7
Colombo, Ceylon ...	91·8	3	71·5	11	89·8	76·3	75·2	80	157·9	70·6	5·96	16	6·9
Hongkong	85·9	30	56·8	1	77·1	69·2	68·2	85	...	...	4·43	14	7·9
Sydney	87·9	27	52·3	13	74·7	58·5	57·1	74	137·9	44·5	3·20	15	5·1
Melbourne	83·5	25	40·9	28	72·2	50·6	49·8	65	13 ·2	34·4	·74	8	4·9
Adelaide	93·4	4	47·2	11	78·8	58·1	51·3	53	150·0	37·6	·27	4	5·2
Perth	87·7	10	50·4	17	74·6	58·0	55·7	64	153·4	44·6	·55	4	4·4
Coolgardie	87·8	15	46·8	18	76·5	53·7	48·8	53	149·8	42·8	4·15	7	3·6
Hobart, Tasmania ..	76·7	5	39·5	1	65·5	49·5	46·6	65	123·0	30·6	1·09	9	6·6
Wellington	67·5	2	38·2	16	60·7	49·7	47·8	76	143·0	26·6	1·93	12	6·5
Jamaica, Kingston ..	91·7	13	68·1	26	87·8	72·3	69·6	77	...	...	2·40	5	4·7
Grenada	89·0	8*	73·0	20†	86·0	75·0	...	72	137·0	...	·85	10	4·2
Toronto	62·8	20	9·9	1	50·9	34·3	31·3	69	128·2	8·0	2·89	15	6·5
Fredericton	65·0	28	19·0	2,4,5	49·0	30·4	30·9	71	...	...	2·95	12	6·7
St. John, N.B. ...	52·5	24	20·5	2	44·2	32·2	31·2	77	122·1	20·0	4·37	15	7·4
Victoria, B.C.	67·2	23	36·8	8	55·5	42·4	41·0	79	133·0	26·8	2·90	14	5·8
Bombay Jan. ...	86·7	7	61·1	13	82·7	68·3	64·0	69	133·0	52·6	·11	1	1·5
Bombay Feb. ...	85·1	9	64·0	19	82·6	68·6	64·7	71	130·0	55·3	·00	0	1·1
Bombay March ...	91·0	28	70·7	5	85·1	72·9	69·6	75	129·4	63·0	·00	0	1·1

*12 and 29. † and 22.

Johannesburg.—Bright sunshine 267·2 hours.

Bloemfontein.—The warmest April ever recorded.

COLOMBO, CEYLON.—Mean temp. 83°·0, or 0°·4 above, dew point 0°·5 above, and R 1·11 in. below, averages. Mean hourly velocity of wind 4·0 miles. TSS on 3 days.

HONGKONG.—Mean temp. 72°·5. Bright sunshine, 154·2 hours. Mean hourly velocity of wind 12·5 miles.

Melbourne.—Mean temp. 1°·9 above, and R 1·53 in. below, averages.

Adelaide.—Mean temp. 4°·6 above the average, with two exceptions highest for April in 62 years.

Perth.—R 1·06 in. above average.

Coolgardie.—R about 3 inches above average.

Wellington.—Mean temp. 1°·7 below, and R 2·06 in. below, averages. Bright sunshine, 147·5 hours. Frost on 9 mornings.

Symons's

Meteorological Magazine.

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BRITISH ASSOCIATION AT BOURNEMOUTH.

METEOROLOGICAL LUNCHEON.

Meteorologists and others interested in weather science gathered together on Thursday, September 11th, at a luncheon held in Linden Hall, Bournemouth. Sir Napier Shaw was in the chair, and among those present were Lady Shaw, Prof. H. H. and Mrs. Turner, Prof. and Mrs. Schuster, Mr. Acland, Mr. P. Y. Alexander, Mr. Wilson Fox and Sir R. Gregory. The Overseas Dominions were represented by Sir Frederick Stupart, Director of the Canadian Meteorological Service, and Lt.-Col. D. C. Bates, Director of the Meteorological Service of New Zealand.

After the usual loyal and patriotic toasts, Mr. Wilson Fox proposed the toast of "Meteorology" coupled with the name of Sir Napier Shaw, who responded.

Mr. J. J. Shaw proposed the toast of "Seismology" drawing attention to the difficulties that had been encountered owing to the war, in that many stations were either inoperative or cut off from communication. The chief station, Shide, was just closed owing to Mrs. Milne's return to Japan, but by a very timely benefaction from Dr. J. E. Crombie, of Aberdeen, in recognition of the unceasing enthusiasm of Prof. Turner, it was now practicable to make a start at Oxford, where Prof. Turner would be able to continue his supervision.

Reference was also made to the help which both Sir Napier Shaw and Dr. A. Schuster had given to Seismology in the past. It was appropriate that meteorology and seismology should be joined at the lunch, since it was of frequent occurrence both here and abroad that seismology had become a protegé of meteorology. The speaker pointed out the need for good observers and co-ordination and believed that the British Dominions alone owing to their geographical distribution could provide the whole of the observation required for a complete investigation of seismology and he specially appealed to their guest, Sir Frederick Stupart, of the Weather

Bureau of Canada, to do what he could in this direction. In conclusion, were it only for the injunction given him by Prof. John Milne, three days before he died, "to carry on with seismology," it gave him much pleasure to propose that toast.

Prof. Schuster responded.

Prof. H. H. Turner proposed "The Guests," coupled with the names of Sir Frederick Stupart (Canada) and Lt.-Col. Bates, (New Zealand). Sir F. Stupart, in replying, expressed his great pleasure in being present. As a Canadian he felt that it was well that those who dwelt in the Overseas Dominions should rub shoulders with their colleagues of the Mother Country. While the Meteorological Services of the British Dominions were autonomous an intimate knowledge of the service of Great Britain was desirable, and this could only be obtained in England. As conditions were to-day, this knowledge could only lead to a very high degree of respect for any opinions and suggestions which might come from the Office presided over by Sir Napier Shaw. The speaker also referred to the increased knowledge of Canada and its people brought about by the war, and in concluding spoke with appreciation of the presence of the Prince of Wales in the Dominions.

Lt.-Col. D. C. Bates also responded to the toast, and remarked that a voyage of fifty-one nights and days separated him from home on the other side of the world, but unity of purpose had drawn them together at this juncture to secure the scientific results won at the cost of so much effort and sacrifice in the great war. Men of science had to safeguard public services at this period of financial stress and political strife. They must stand together to safeguard the treasures won from the past and hand on to the future all that was good, useful and true. There was, of course, great need for economy in the aftermath of war, but it was to be hoped that the best in civilization would not be sacrificed to the cry for money. Ideals were more precious than gold, and scientific men who sacrificed time, pleasure and wealth, must now be ready to join together to carry on their work with even greater energy and zeal. He paid a tribute to the Chairman, Sir Napier Shaw, the doyen of the world's meteorology, who greeted them with open heart and mind, and he trusted British meteorology would always continue to be in the forefront of the world's advance. He regretted the absence of Dr. H. R. Mill from the gathering.

Previous to the luncheon Sir Frederick Stupart read a paper before Section A, on "Some Unsolved Problems in Canadian Weather," making special reference to the climatic peculiarities of the province of Alberta. He referred to the pressure and temperature conditions of two recent consecutive Januaries in which the mean temperatures at Calgary were 16° F. and 47° F. respectively. During the cold January the mean pressure of the month in the north-west of Canada was as high as 30·75 in., but

in the mild January only 29·97 in. In the cold January there was intense terrestrial radiation and light northerly winds prevailed, but in the mild January with the low pressure, Föhn (Chinook) winds persisted, and the temperature in Alberta was high continuously. The Föhn effect was due to the winds from the Pacific having to traverse four mountain chains so that they were dynamically warmed winds. In the discussion that followed Sir Napier Shaw pointed out certain objections that applied to the conventional explanation of Föhn effects.

ON THE DESIGNATIONS: RAIN, SNOW AND HAIL.

By L. C. W. Bonacina.

Of each of the three primary kinds of precipitation falling to the ground from a height, namely: rain, snow and hail, there are numerous varieties, and there are also various transition forms between them. In the case of hail, three of its varieties are so very distinct and characteristic as almost to be entitled to be called sub-species. Thus we have (1) hard or true hail, a complex structure often, though not only, associated with thunderstorms; (2) soft hail, graüpel or grésil, a type of precipitation of which there are endless varieties, common in cold weather, tending towards snow, and often associated with it; (3) ice-rain, which takes the form of more or less clear spherules of ice formed generally during temperature inversions when rain-drops fall through a cold surface stratum of air giving rise to glazed frost. A few years ago I used to regard graüpel as a distinct species of precipitation from hail, and object to the official practice of forecasting it as "hail." But I have since come to the conclusion that it is philosophically correct to regard graüpel merely as a variety or sub-species of hail, and for this reason. If we take the concepts "rain," "snow" and "hail," words belonging to the bed-rock of common language, what do we find to be the specific character of each? The physical criterion of "rain" is the spherical drop of water; of "snow" the separately formed crystal of ice whether it falls alone, in contact with others as a flake, or broken up into dust-like fragments by wind; and of hail the stone or pellet of compact ice. It is clear that ordinary hail, graüpel and frozen rain, however much they may differ in minor respects, have each the fundamental character of being agglomerations of compact ice, and I therefore think they should all be regarded as "hail"—a fundamental species of precipitation on the same footing with "rain" and "snow."

ROYAL METEOROLOGICAL SOCIETY.

At a special meeting of the Society on November 7th at 70, Victoria Street, Prof. V. Bjerknes, of the Norwegian Meteorological Service, Bergen, delivered a lecture on "The Structure of the Atmosphere when Rain is Falling." The President, Sir Napier Shaw, was in the chair.

Owing to the restriction of meteorological data during the war, opportunity was taken largely to increase the number of telegraphic reporting stations in Norway, and to develop Prof. Bjerknes's method of studying atmospheric movements on an intensive scale. The process of mapping air stream lines was described and these were associated by means of a series of extremely instructive lantern slides, with the areas of rainfall. The various types of rainfall were found to be, the orographical, caused by the impinging of lines of air-flow on rising land, setting up ascending currents; secondly, the interaction of drifts of different temperature by means of which (*a*) the warmer current was forced over the flank of the colder which operated similarly to a mountain side, or (*b*) the colder mass of air forced its way as a wedge under the warmer, lifting the latter bodily into the upper strata; thirdly, the development and flow of convection currents giving rise to local showers. The second type of rain, viz., that caused by the meeting of two drifts of air, was that associated with cyclones, and the conception of the cyclone as a spirally moving system was no longer tenable. The lecturer figured the construction of the system in the light of a warm south-westerly wind, striking the flank of cold easterly wind and rising over it, causing rain of a widespread nature without much rise of temperature; the easterly wind passing round the centre of low pressure, subsequently attacked the south-westerly wind on its north-western flank and forcing its way below it gave rise to the squall line in the rear of the system, with the characteristic fall of temperature. This explanation was quite in accord with the conclusions arrived at from different premises by Sir Napier Shaw. Convection effects were described in great detail and the accumulative effect of converging air-drifts as influenced by temperature changes from day to day was vividly set out in a series of maps showing the development of thunderstorms over a considerable area. It was possible to detect the effect of physical features, such as the fiords, glaciers and great lakes, on the air movements. In conclusion the lecturer appealed for a more extensive use of his methods, particularly in the British Isles.

Sir Napier Shaw congratulated Prof. Bjerknes on having carried out in a detailed manner in Norway the work which he had formerly done on a general scale for the United States. Mr. Richardson, of Benson Observatory, Lt.-Col. E. Gold, and Mr. M. A. Giblett, took part in the discussion.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

ROYAL METEOROLOGICAL SOCIETY PHENOLOGICAL RETURNS.

With 1920 the phenological records collected by the Royal Meteorological Society complete the period of thirty years, a recognised critical epoch in Meteorological records.

In consequence of the war, our observing stations had fallen to 110 last year, against the high-water mark of 182, in 1914. We are most anxious now to recover lost ground, and would like to make 1920 preparatory in this respect to the years that follow.

A reasonable total would be at least 220 stations, an average of twenty only for the eleven Meteorological Office districts. At present we are short of this in all districts except England S.E. and the Midlands. The six districts forming Scotland, Ireland and England, N.E. average only three and a half stations each. Wales has two stations only, both in the south-west.

The observations asked for refer to the blooming of thirteen common flowers, and appearance of six birds and six insects. Other migrant records and notes are also invited, but these are of secondary importance.

A copy of the observing form and of a recent report will be sent with pleasure (the reports so far as available) to any of the readers of *Symons's Meteorological Magazine*, who would be interested in helping. We especially suggest the value of these observations to all interested in Nature Study or Regional Survey classes.

Enquiries should be addressed to one of the undersigned, or to the Assistant Secretary, Royal Meteorological Society, 70, Victoria Street, S.W. 1.

33, Holcombe Road, Ilford, Essex. H. B. ADAMES.

"Asgarth," Purley, Surrey. J. EDMUND CLARK.

THE SNOWFALL OF SEPTEMBER, 1919.

The snowfall of September on the Snowdonian range, extended down to 1,200 feet O.D. to the depth of 6 inches. Above 2,500 feet the snow drifted and remained unmelted in a few places for a week, being only some 10 weeks after the disappearance of last winter's drifts. This snowfall extended to a lower elevation than any known to me for the month of September.

J. R. GETHIN JONES.

Bryn Awel, St. Mary's Road, Llandudno, October 13th, 1919.

SEPTEMBER TEMPERATURES.

In the October number the Rev. R. P. Dansey calls attention to the severe frost which occurred at the end of September. At Greenwich the shade reading on the morning of the 29th was 31°, which was 3° colder than any previous record on the corresponding day since 1841, and the reading of 32° on the 30th was 2° below any reading on that day. On September 11th the thermometer registered 87° in the shade at Greenwich, which is 4° higher than any previous temperature on the corresponding day for at least 78 years. The reading of 30°·9 at Greenwich on September 29th, is the only September reading below the freezing point in the screen registered since 1841, with the single exception of 30°·6 on September 27th, 1885. The grass temperatures were respectively 19°·1 last September and 22°·3 in 1835

Mr. Dansey in the letter which you publish says, "September, 1919, closed with severe frost, the exposed thermometer 4 feet above ground on the morning of the 29th registering a minimum of 21°, the lowest September reading recorded in 33 years observations . . ." Is "the exposed thermometer 4 feet above ground" a slip? It is not a recognised meteorological exposure.

I have before me a letter by Mr. Dansey, printed in the *Standard* of October 3rd, 1898, on "a month of contrasts," dealing with exceptionally high and low temperatures in the previous September. September this year also had very divergent temperatures.

CHAS. HARDING.

Meteorological Office, S.W. 7, 31st October, 1919.

WIND IN RELATION TO TIDE.

Mr. Twist's letter, on p. 105, on his experiences in the Bristol Channel, recalls to me my own, which I mentioned in a note in my translation of "Theophrastus on Winds and Weather Signs," p. 35. The author there referred to tidal phenomena and reversal of winds in the Euripus; and in my note I wrote: "the tidal phenomena in question may have had a connection, unsuspected by Theophrastus, with the reversal of the wind. Often in past years have I watched at Chepstow the cessation of a storm, the clearing of the weather, or the shift of the wind coincidently with the beginning of the ebb of the great (though generally misrepresented and exaggerated) tides in the Wye."

Thus my observations at a point some thirty miles further up the same tideway than Minehead, agree in the main with Mr. Twist's; with this variation, that with him the change was generally noticed at the beginning of flood; with me at the beginning of ebb. Many a time, in weather which threatened to interfere with some outing, we said "we will wait till the tide turns." JAMES G WOOD.

11b, Sutherland Avenue, W. 9, November, 2nd 1919.

An aunt who lived in this town for sixty years, used to say, when the sea ebbed, "The wind will fall when the tide turns."

Another old lady in Mid-Devon steadily consulted the tide table for Exmouth to know when the weather would change. My aunt died at 92 years; the other at about 96. They had time for experience! L.J.B.G.

Charlton House, Dawlish, October 17th, 1919.

TETRAHEDRAL HAILSTONES ON OCTOBER 13th, 1919.

On the afternoon of Monday, October 13th, there passed over the Chiltern district of South Bucks a somewhat violent squall accompanied by heavy hail, and showing the long dark roll of black cloud typical of the true line-squall structure. At 2.50 p.m. the disturbance struck the town of Amersham, where I happened to be, and just prior to the veering of the wind a point or two from west, a dense mass of hail literally swooped out of the squall cloud. I was out at the time and avoided immediately seeking shelter in order to examine the shape and texture of the hailstones. I found that all those which I caught on the sleeve of my overcoat were white and opaque, and in shape tetrahedral, showing four triangular faces roughly between $\frac{1}{8}$ and $\frac{1}{4}$ of an inch in length from base to vertex. I believe it is rather unusual for hail to form in regular geometric figures, and it would have been interesting to examine the structure of the stones microscopically to see if they exhibited the usual alternate structure of snow and clear ice. It may be noted, on the other hand, that at 4 p.m. on the following day I observed near the village of Stokenchurch, higher up towards the Chiltern escarpment, transparent spheroids of clear ice, which I took to be frozen rain, a species of frozen precipitation which would appear to be genetically and structurally different from hail, and also from those little snowballs called graupel so common in an English winter. It might be added that the squall of October 13th, which struck Amersham at 2.50 p.m. was observed at Beaconsfiefd at 3.5 p.m., so that it may be estimated that the disturbance was not travelling at a greater rate than about fifteen miles an hour. An hour or so later the line of cumuloform squall cloud surmounted by much anvil-shaped false cirrus was still above the horizon. No thunder was heard on the 13th, nor on the 14th, but during a similar type of shower on the afternoon of the 15th I noted two peals while walking along the Chiltern escarpment above Chinnor.

The whole period, 13th—16th, was bleak and wintry.

L. C. W. BONACINA.

27, Tanza Road, Hampstead, N.W., 3, October 20th, 1919.

Lieut.-Col. B. E. F. Keeling, M.C., R.E.

The death of Col. B. E. F. Keeling on September 20th, only shortly after his appointment as Director-General of the Survey Department of the Egyptian Government, cuts short a career of great promise in connection with meteorology in north-east Africa, the development of which is so largely owing to Col. H. G. Lyons. Before joining the Survey Department, in 1904, Col. Keeling was attached to the Royal Arsenal, Woolwich, and later to the Metrological Department of the National Physical Laboratory, Teddington. In Egypt, although primarily engaged on duties in connection with surveying and metrology, he was closely associated with the meteorological and magnetic work at the Helwan Observatory, and carried out kite and pilot balloon observations as well as special investigations of the upper air conditions during the monsoon season.

He later took charge of the Physical Service as distinct from the Survey Department, but during the war carried out survey duties in England, France and the Eastern Mediterranean, being severely wounded in France.

His meteorological publications include, besides the annual meteorological report of the Helwan Observatory, reports on the "Climate of Abbassia," "Evaporation in Egypt," and "Terrestrial Magnetism in North-east Africa."

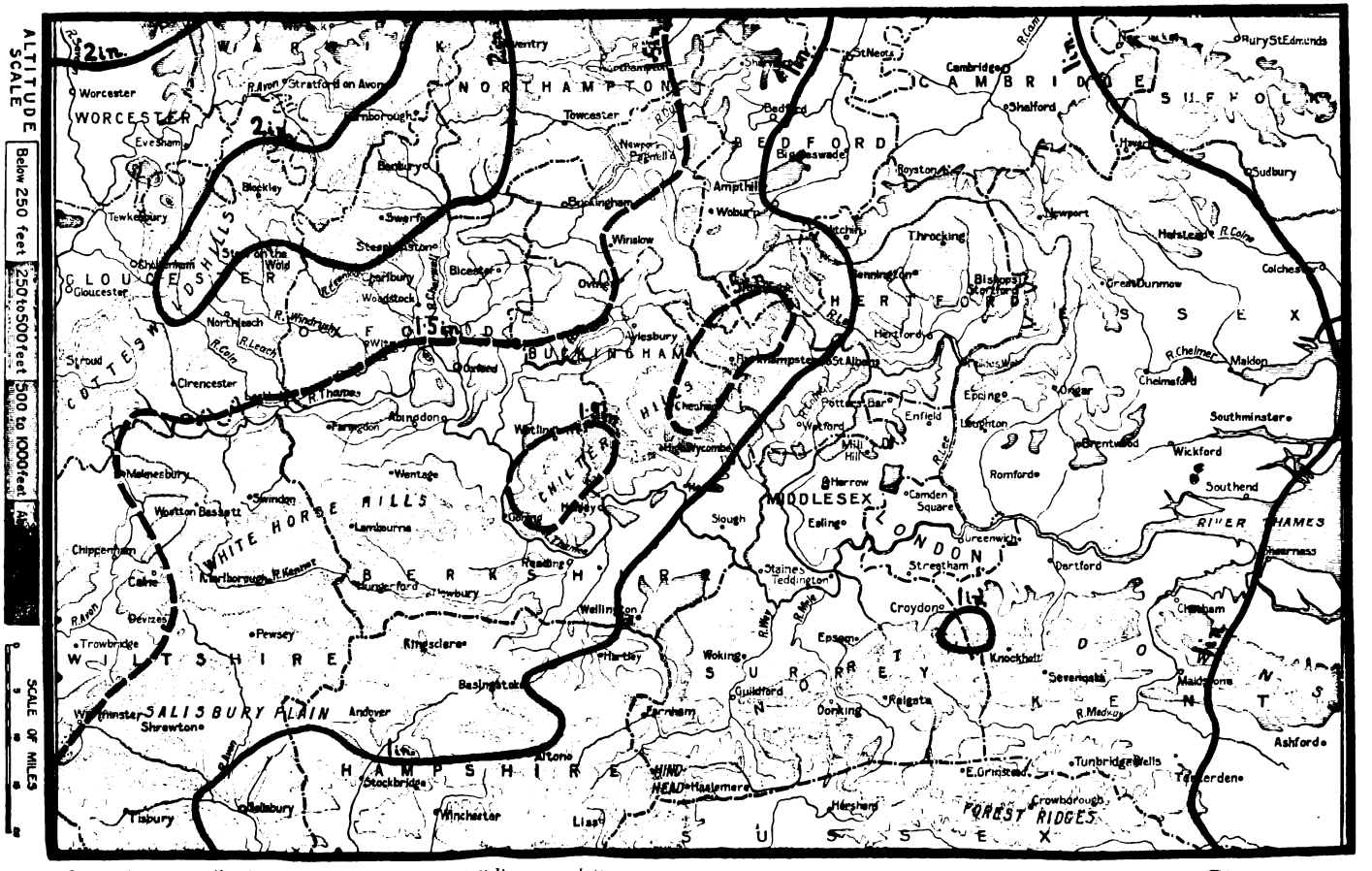
METEOROLOGICAL NEWS AND NOTES.

An American Meteorological Society is being formed and it is proposed that its inauguration shall be definitely taken in hand at the meeting of the American Academy of Arts and Sciences in St. Louis in December, 1919.

Mr. R. Lamport retired from the staff of the British Rainfall Organization on October 25th after thirty-one years' service, successively under the late Mr. G. J. Symons, Mr. H. Sowerby Wallis, Dr. H. R. Mill and the Meteorological Office. Miss D. K. Lamport has been appointed as a temporary assistant on the staff as from October 27th.

General Table of "British Rainfall, 1918."—Owing to the great demand for this reprint, the stock is already exhausted. Any Observers who do not wish to retain their copies are requested to return them to the Superintendent, British Rainfall Organization, 62, Camden Square, N.W. 1.

THAMES VALLEY RAINFALL OCTOBER, 1919.


ALTITUDE SCALE
Below 250 feet
250 to 500 feet
500 to 1000 feet
SCALE OF MILES
2in.
1in.
WORCESTER
GLOUCESTER
WARWICK
NORTHAMPTON
BEDFORD
BUCKINGHAM
HEREFORD
CAMBRIDGE
SUFFOLK
ESSEX
MIDDLESEX
LONDON
SURREY
KENT
BERKSHIRE
WILTSHIRE
HAMPSHIRE
SUSSEX
OXFORD
Stratford on Avon
Coventry
Towcester
Bedford
Cambridge
Bury St Edmunds
Worcester
Evesham
Tewkesbury
Cheltenham
Gloucester
Stroud
Cirencester
Northleach
Stow on the Wold
Chipping Norton
Woodstock
Bicester
Banbury
Buckingham
Winslow
Aylesbury
Amptill
Wobum
Hitchin
Royston
Newport
Saffron Walden
Sudbury
Halstead
Colchester
Throcking
Bishops Stortford
Great Dunmow
Chelmsford
Maldon
Southminster
Wickford
Southend
Epping
Ongar
Hertford
Watford
Enfield
Harrow
Hill
Romford
Camden Square
Ealing
Slough
Greenwich
Dartford
Croydon
Epsom
Woking
Guildford
Reigate
Dorking
Farnham
Basingstoke
Andover
Newbury
Reading
Wallingford
Abingdon
Faringdon
Witney
Malmesbury
Wantage
Lambourne
Chippenham
Calne
Devizes
Trowbridge
Pewsey
Ringslere
Hartley
Wellington
Staines
Teddington
Streatham
Knockholt
Sevenoaks
Maidstone
Ashford
Tunbridge Wells
Tenterden
Crowborough
E. Grinstead
Haslemere
Petersfield
Winchester
Stockbridge
Salisbury
Shrewton
Warminster
Tisbury
Lias
Hindhead
Hershem
Chesham
Berkhamsted
St Albans
Hemel Hempstead
Pottersbar
Watford
Mill Hill
Harrow
Camden Square
Romford
Epping
Ongar
Brentwood
Wickford
Southend
Southminster
Maldon
Chelmsford
Halstead
Sudbury
Newport
Throcking
Bishops Stortford
Great Dunmow
Colchester
Hertford
Ware
Royston
Ampthill
Wobum
Hitchin
Bedford
Biggleswade
Towcester
Newport Pagnell
Buckingham
Winslow
Aylesbury
Thame
Wallingford
Abingdon
Faringdon
Witney
Oxford
Woodstock
Bicester
Banbury
Chipping Norton
Stow on the Wold
Northleach
Cirencester
Stroud
Gloucester
Cheltenham
Tewkesbury
Evesham
Worcester
Stratford on Avon
Coventry
Towcester
Newport Pagnell
Bedford
Biggleswade
Royston
Saffron Walden
Sudbury
Cambridge
Bury St Edmunds
St Neots
Huntingdon
Peterborough
Wisbech
Ely
Newmarket
Haverhill
Halstead
Colchester
Maldon
Chelmsford
Southminster
Wickford
Southend
Ongar
Epping
Brentwood
Romford
Dartford
Greenwich
Woolwich
Deptford
Lewisham
Camberwell
Chelsea
Kensington
Hammersmith
Brentford
Staines
Teddington
Streatham
Croydon
Chesham
Knockholt
Sevenoaks
Maidstone
Ashford
Tenterden
Tunbridge Wells
Crowborough
E. Grinstead
Haslemere
Petersfield
Winchester
Stockbridge
Salisbury
Shrewton
Warminster
Tisbury
Lias
Hindhead
Hershem
Chesham
Berkhamsted
St Albans
Hemel Hempstead
Pottersbar
Watford
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Brentwood
Wickford
Southend
Southminster
Maldon
Chelmsford
Halstead
Sudbury
Newport
Throcking
Bishops Stortford
Great Dunmow
Colchester
Hertford
Ware
Royston
Ampthill
Wobum
Hitchin
Bedford
Biggleswade
Towcester
Newport Pagnell
Buckingham
Winslow
Aylesbury
Thame
Wallingford
Abingdon
Faringdon
Witney
Oxford
Woodstock
Bicester
Banbury
Chipping Norton
Stow on the Wold
Northleach
Cirencester
Stroud
Gloucester
Cheltenham
Tewkesbury
Evesham
Worcester
Stratford on Avon
Coventry
Towcester
Bedford

THE WEATHER OF OCTOBER.

ONE of the chief features (one might perhaps describe it as the ruling factor) in the weather of a very remarkable month, was the almost complete absence of the mild and humid south-westerly winds which prevail with so much energy in an ordinary October.

Between the 3rd and 8th of the month, and again from about the 16th to the 22nd, when the distribution of pressure was anticyclonic, the winds were light and rather variable, the days being often bright and sunny, but the nights cold and foggy. These conditions prevailed more especially over England; in Ireland and Scotland the air was milder and clearer, and between the 4th and 6th the thermometer rose slightly over 70° in some parts of North Britain, as well as in the south of Ireland, and touched 73° at Gordon Castle. The sharpest night frosts occurred between the 7th and 14th, when the sheltered thermometer fell in many places, and on at least two or three occasions to 5° or more below the freezing point. On the surface of the grass the lowest readings were observed on the night of the 14th, the exposed thermometer falling to a minimum of 17° at Newton Rigg (Cumberland) and Phœnix Park (Dublin), and to 18° at Blackpool, Rounton, Worksop and Cambridge. Around the middle of the month, and in the closing week, the conditions were cyclonic, but the wind blew mainly from some polar quarter (between N.W. and N.E.), and the weather was therefore cold and inclement, with local falls of snow or sleet and further touches of sharp night frost. The harsh and stormy weather which prevailed between the 27th and 30th was due to a well marked barometric depression which moved in the first place eastward from Iceland, and afterwards southward across the North Sea and France to the western Mediterranean. On the 27th to 29th the northerly winds on the western edge of this disturbance increased to the force of a gale in many parts of Great Britain, snow or sleet fell in places, and a heavy downpour of rain occurred over northern England, the total amount at Rounton (N. Yorkshire) for three days being 2·86 inches. In the English midland and south-eastern counties the unusual coldness of the nights is attested by the fact that at Kew and Nottingham the mean of all the minimum temperatures was the lowest recorded in October for at least 50 years past. At Kew an average of 12 years' observations shews that ground frost does not occur in October on more than 7 occasions; last month it was reported on 19 nights, and at Benson on 23 nights.

Nearly all places experienced more than the average duration of bright sunshine; at Glasgow the total, 104 hours, was 37 in excess of the normal.

A brilliant display of aurora was seen on the night of the 31st as far south as the Isle of Wight.

The rainfall of the month was deficient over the whole of the British Isles with the exception of certain areas in the east, including part of Norfolk, a strip of the coast from the Humber to Berwick, and a portion of north-east Aberdeenshire. More than 5 inches fell locally in these districts. A considerable portion of the south-east of England and small areas in the south-east of Ireland and the centre of Scotland had less than an inch of rain during the month. Apart from the east coast more than 3 inches was confined to the normally rainy districts of the west, but over a large part of the Lake District less than that amount fell. The general rainfall expressed as a percentage of the average was:—England and Wales, 59; Scotland, 57; Ireland, 42; British Isles, 55. Taken generally the month was probably one of the driest Octobers of which there is any record.

In London (Camden Square) the month was dull and cold. The rainfall was the lowest for October in the 62 years record with the single exception of October, 1897. Mean temperature, 45°·7, or 4°·4 below the average, and the lowest for October since 1892. Duration of rain, 22·4 hours. Evaporation, ·61 inch.

RAINFALL TABLE FOR OCTOBER, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875–1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·72	·69	—2·03	25	·26	29	9
Tenterden	*Kent*	3·48	1·17	—2·31	34	·37	31	10
Arundel (Patching)	*Sussex*	4·01	·48	—3·53	12	·20	24	5
Fordingbridge (Oaklands)	*Hampshire*	3·97	·70	—3·27	18	·38	24	8
Oxford (Magdalen College)	*Oxfordshire*	2·82	1·37	—1·45	49	·66	24	12
Wellingborough	*Northampn*	2·60	1·52	—1·08	58	·46	23	13
Bury St. Edmunds (Westley)	*Suffolk*	2·72	1·17	—1·55	43	·24	27, 29	12
Geldeston [Beccles]	*Norfolk*	2·84	2·75	— ·09	97	·44	28	19
Polapit Tamar [Launceston]	*Devon*	4·84	1·94	—2·90	40	·27	14, 23	16
Rousdon [Lyme Regis]	,,	3·81	2·03	—1·78	53	1·00	24	11
Ross (Birchlea)	*Herefordshr.*	3·21	2·39	— ·82	74	1·00	23	13
Church Stretton (Wolstaston)	*Shropshire*	3·77	3·25	— ·52	86	1·15	23	14
Boston	*Lincoln*	2·75	1·86	— ·89	78	·52	27	17
Worksop (Hodsock Priory)	*Nottingham*	2·77	2·27	— ·50	82	·76	29	16
Mickleover Manor	*Derbyshire*	2·81	2·46	— ·35	88	1·16	23	10
Congleton (Buglawton Vic.)	*Cheshire*	3·10	2·35	— ·75	76	·66	23	16
Southport (Hesketh Park)	*Lancashire*	3·74	2·87	— ·87	77	1·28	23	12
Wetherby (Ribston Hall)	*York, W.R.*	3·18	3·28	+ ·10	103	·91	23	12
Hull (Pearson Park)	,, *E.R.*	3·19	4·31	+1·12	135	·79	23	17
Newcastle (Town Moor)	*North'land*	3·20	5·63	+2·43	176	1·15	23	17
Borrowdale (Seathwaite)	*Cumberland*	12·71	2·30	—10·41	18	...	...	...
Cardiff (Ely)	*Glamorgan*	4·87	2·47	—2·40	51	1·25	23	12
Haverfordwest	*Pembroke*	5·51	1·95	—3·56	35	·75	23	15
Aberystwyth (Gogerddan)	*Cardigan*	5·38	3·83	—1·55	71	1·86	23	11
Llandudno	*Carnarvon*	3·78	2·98	— ·80	79	1·10	23	12
Cargen [Dumfries]	*Kirkcudbrt.*	4·45	1·51	—2·94	34	·78	23	13
Marchmont House	*Berwick*	3·83	3·32	— ·51	87	1·10	23	14
Girvan (Pinmore)	*Ayr*	5·38	1·70	—3·68	32	·60	22	13
Glasgow (Queen's Park)	*Renfrew*	3·36	·82	—2·54	24	·31	23	8
Islay (Eallabus)	*Argyll*	4·95	2·63	—2·32	53	·65	22	18
Mull (Quinish)	,,	5·87	3·89	—1·98	66	·82	3	23
Loch Dhu	*Perth*	7·53	1·60	—5·93	21	·40	1	11
Dundee (Eastern Necropolis)	*Forfar*	2·81	1·62	—1·19	58	·40	22	15
Braemar	*Aberdeen*	3·88	2·63	—1·25	68	·95	26	17
Aberdeen (Cranford)	,,	3·23	3·12	— ·11	97	·48	22	23
Gordon Castle	*Moray*	3·38	3·74	+ ·36	111	...	...	...
Drumnadrochit	*Inverness*	3·49	1·98	—1·51	57	·40	13	19
Fort William	,,	7·32	3·22	—4·10	44	·86	22	19
Loch Torridon (Bendamph)	*Ross*	8·38	5·56	—2·82	66	·96	26	20
Dunrobin Castle	*Sutherland*	3·15	3·00	— ·15	95	·60	12	12
Glanmire (Lota Lodge)	*Cork*	4·35	·65	—3·70	15	·30	22	12
Killarney (District Asylum)	*Kerry*	5·59	...	...	...	...	...	...
Waterford (Brook Lodge)	*Waterford*	4·00	·39	—3·61	10	·11	23	5
Nenagh (Castle Lough)	*Tipperary*	3·48	·62	—2·86	18	·41	22	9
Ennistymon House	*Clare*	4·40	1·07	—3·33	24	·43	22	9
Gorey (Courtown House)	*Wexford*	3·75	1·51	—2·24	40	·83	23	8
Abbey Leix (Blandsfort)	*Queen's Co.*	3·53	1·11	—2·42	31	·50	23	11
Dublin (Fitz William Square)	*Dublin*	2·88	2·37	— ·51	82	1·25	23	15
Mullingar (Belvedere)	*Westmeath*	3·19	1·50	—1·69	47	·38	23	13
Crossmolina (Enniscoe)	*Mayo*	5·27	2·46	—2·81	47	·39	19	22
Cong (The Glebe)	,,	4·60	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	4·21	1·83	—2·38	43	·27	14	15
Seaforde	*Down*	3·65	1·99	—1·66	54	·58	22	14
Ballymena (Harryville)	*Antrim*	3·78	3·41	— ·37	90	·66	13	20
Omagh (Edenfel)	*Tyrone*	3·76	2·25	—1·51	60	·58	22	19

SUPPLEMENTARY RAINFALL, OCTOBER, 1919.

Div.	STATION.	Rain inches.
II.	Sevenoaks, Speldhurst Close.	·75
,,	Ramsgate	1·74
,,	Hailsham	·82
,,	Totland Bay, Aston House...	·91
,,	Stockbridge, Ashley..	·97
,,	Grayshott	·50
,,	Upton Nervet	1·17
III.	Harrow Weald, Hill House...	·64
,,	Pitsford, Sedgebrook	1·59
,,	Woburn, Milton Bryant	...
,,	Chatteris, The Priory	·66
IV.	Elsenham, Gaunts End	·73
,,	Rayleigh	·68
,,	Colchester, Hill Ho., Lexden	1·09
,,	Aylsham, Rippon Hall	3·71
,,	Swaffham	2·12
V.	Bishops Cannings	1·45
,,	Weymouth	1·85
,,	Ashburton, Druid House	2·09
,,	Cullompton	2·75
,,	Lynmouth, Rock House	1·87
,,	Okehampton, Oaklands	...
,,	Hartland Abbey	1·81
,,	St. Austell, Trevarna	1·98
,,	North Cadbury Rectory	2·01
VI.	Clifton, Stoke Bishop	2·88
,,	Ledbury, Underdown	2·58
,,	Shifnal, Hatton Grange	3·23
,,	Droitwich	2·24
,,	Blockley, Upton Wold	2·16
VII.	Grantham, Saltersford	1·91
,,	Louth, Westgate	3·00
,,	Bawtry, Hesley Hall	2·38
,,	Derby, Midland Railway	2·42
VIII.	Nantwich, Dorfold Hall	3·73
,,	Bolton, Queen's Park	1·06
,,	Lancaster, Strathspey	2·73
IX.	Langsett Moor, Up. Midhope	...
,,	West Witton	4·85
,,	Scarborough, Scalby	6·36
,,	Ingleby Greenhow	6·87
,,	Mickleton	3·40
X.	Bellingham, High Green Manor	3·87
,,	Ilderton, Lilburn Cottage	4·09
,,	Keswick, The Bank	2·01
,,	Orton	3·03
XI.	Llanfrechfa Grange	2·65
,,	Treherbert, Tyn-y-waun	2·62
,,	Carmarthen, The Friary	1·93
,,	Fishguard, Goodwick Station.	2·01
,,	Crickhowell, Tal-y-maes	2·00
,,	Birmingham WW., Tyrmynydd	3·12
,,	Lake Vyrnwy	...
,,	Llangynhafal, Plas Drâw	4·60
,,	Rhiwbryfdir	4·18
,,	Dolgelly, Bryntirion	4·22
XI.	Lligwy	3·21
,,	Douglas, Isle of Man	...
XII.	Stoneykirk, Ardwell House	2·10
,,	Carsphairn, Shiel	1·47
,,	Langholm, Drove Road	2·67
XIII.	Selkirk, The Hangingshaw	3·01
,,	North Berwick Reservoir	2·17
,,	Edinburgh, Royal Observaty.	2·37
XIV.	Biggar	2·05
,,	Maybole, Knockdon Farm	·61
XV.	Shiskine	1·99
,,	Ardgour House	4·82
,,	Oban	2·15
,,	Holy Loch, Ardnadam	2·16
,,	Loch Venachar	1·30
XVI.	Glenquey	1·90
,,	Loch Rannoch, Dall	·77
,,	Blair Atholl	...
,,	Coupar Angus	·88
,,	Montrose, Sunnyside Asylum.	2·18
XVII.	Balmoral	2·76
,,	Fyvie Castle	5·36
,,	Keith Station	5·25
XVIII.	Rothiemurchus	...
,,	Loch Quoich, Loan	...
,,	Skye, Dunvegan	4·29
,,	Fortrose	1·82
,,	Glencarron Lodge	...
XIX.	Tongue Manse	3·85
,,	Melvich	2·51
,,	Loch More, Achfary	6·86
XX.	Dunmanway, The Rectory	1·18
,,	Mitchelstown Castle	1·30
,,	Gearahameen	3·20
,,	Darrynane Abbey	2·76
,,	Clonmel, Bruce Villa	·46
,,	Roscrea, Timoney Park	1·16
,,	Broadford, Hurdlestown	·93
XXI.	Enniscorthy, Ballyhyland	·78
,,	Rathnew, Clonmannon	1·89
,,	Hacketstown Rectory	·89
,,	Ballycumber, Moorock Lodge	1·00
,,	Balbriggan, Ardgillan	2·29
,,	Castle Forbes Gardens	1·81
XXII.	Ballynahinch Castle	2·36
,,	Woodlawn	1·31
,,	Westport House	·90
,,	Dugort, Slievemore Hotel	...
XXIII.	Enniskillen, Portora	1·52
,,	Dartrey [Cootehill]	1·51
,,	Warrenpoint, Manor House	1·40
,,	Belfast, Cave Hill Road	2·07
,,	Glenarm Castle	2·21
,,	Londonderry, Creggan Res.	1·83
,,	Milford Manse	2·53
,,	Killybegs	2·79

Climatological Table for the British Empire, May, 1919.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	82·0	23	41·6	3	70·8	47·5	48·4	70	125·8	38·0	·33	4	4·5
Malta	77·0	21	49·0	2	67·4	57·3	...	82	134·0	...	·57	6	5·0
Lagos	88·4	24	69·0	9	86·1	75·3	73·8	79	163·5	63·3	8·58	22	8·2
Cape Town	92·2	13	38·0	3	73·2	49·8	49·5	66	...	...	1·51	8	3·2
Johannesburg	71·3	11	31·6	7	64·8	43·3	38·1	66	...	29·2	·07	3	1·8
Mauritius	82·4	3, 9	56·1	22	79·2	65·3	63·3	74	..	49·5	·96	9	5·3
Bloemfontein	75·5	26	30·9	3	67·9	37·7	37·4	66	...	...	·37	1	2·6
Calcutta...	104·6	21	68·4	5	95·7	77·9	75·6	74	...	63·2	4·18	7	3·6
Bombay	93·4	31	78·2	3	91·5	81·3	76·2	74	138·0	72·0	·00	0	2·9
Madras	108·2	21	76·5		99·3	81·3	73·2	65	165·6	75·2	·03	2	3·3
Colombo, Ceylon ...	89·9	9	72·2	26	87·7	76·8	75·2	82	157·6	71·0	20·01	24	7·9
Hongkong	88·6	21	69·0	24	80·6	73·6	70·7	82	...	...	6·95	13	8·2
Sydney	86·0	1	48·0	31	68·6	56·9	55·6	81	127·4	41·1	23·03	25	7·3
Melbourne	77·8	5	36·8	17*	62·3	46·3	46·8	74	128·5	30·8	1·66	15	5·7
Adelaide	80·7	5	41·7	16	66·1	51·0	49·0	72	140·2	29·8	2·28	13	5·6
Perth	77·1	2	39·7	9	69·0	51·8	49·3	67	136·3	31·7	2·03	8	3·4
Coolgardie	80·2	4	38·0	9	67·1	46·7	44·1	60	138·2	35·8	1·87	4	4·5
Brisbane	76·6	1	51·9	24	72·4	58·9	56·8	76	137·6	43·6	5·47	18	5·4
Hobart, Tasmania ...	71·8	5	35·9	26	57·9	43·5	41·9	70	113·5	30·3	·76	10	5·6
Wellington	63·4	4	33·6	29	57·0	46·2	45·1	79	114·0	...	1·92	9	6·5
Jamaica, Kingston ...	91·5	6	71·1	1	87·0	73·8	72·4	80	...	...	7·04	10	5·5
Grenada	88·0	1†	74·0	3	85·0	75·0	...	78	135·0	...	5·92	21	5·0
Toronto	91·8	29	38·8	8‡	64·6	45·8	43·3	71	126·0	33·9	5·15	14	5·8
Fredericton	78·5	22	26·0	10	63·1	38·5	39·1	61	...	...	5·28	12	5·1
St. John, N.B. ...	73·9	22	34·7	1	57·5	41·3	39·4	71	135·1	28·0	3·94	11	5·0
Victoria, B.C.	68·5	14	39.8	3	59·4	44·9	41·0	69	137·0	31·8	·79	11	5·2
Brisbane April ...	84·3	8	56·9	13	77·7	62·6	60·1	72	147·7	51·6	1·99	14	5·5
Wellington February	81·1	24	44·9	26	69·6	56·9	54·9	75	152·0	...	2·02	8	5·4

* and 27. † and 26. ‡ and 11.

COLOMBO, CEYLON.—Mean temp. 0°·2 below, dew point 0°·2 below, and R 6·87 in. above, averages. Mean hourly velocity of wind 5·1 miles, prevailing direction S.W. TSS on 8 days.

HONGKONG.—Bright sunshine, 137·5 hours. Mean hourly velocity of wind 11·6 miles, prevailing direction E. Mean temperature 76°·6.

Sydney.—R record for month of May, previous highest 20·87 in. in 1889. Only exceeded on three occasions in any month, the highest being 25·43 in April, 1841. Mean temp. 62°·7, highest on record for May.

Adelaide.—Mean temp. 0°·8 above, R ·44 in. below, averages.

Perth.—R 2·74 in. below normal.

Brisbane.—R above normal, third highest for month in 39 years.

Symons's

Meteorological Magazine.

No. 647. DECEMBER, 1919. Vol. LIV.

John Aitken, LL.D., F.R.S.,

FALKIRK, 1839—13TH NOVEMBER, 1919.

THE death of Dr. John Aitken deprives Meteorology of a very ardent and singularly gifted student. He was a brilliant example of a type which has done much to mould the history of science in Great Britain since the revival of natural knowledge in the sixteenth century. Like Napier of Merchiston, Boyle, Cavendish, Banks, Murchison, Campbell of Islay, and many others, he had sufficient means to devote his best years to scientific investigation untrammelled by the necessity of toiling at a profession or of conforming to the traditions of an institution. An apprenticeship in an engineering works gave him a practical knowledge of mechanical processes which he turned to good account during the many years of quiet country life at Darroch and Ardenlea, near Falkirk, which his uncertain health required. His appearances at meetings of the British Association and various learned societies were infrequent; but whenever he spoke on any of the subjects with which his mind was occupied, he commanded attention by the originality of his methods and the actueness of his observation. He was an adept in devising apparatus to test points of physical theory, and his demonstrations were always as simple and direct as they were conclusive. Had health and circumstances permitted, Dr. Aitken would have been an inspiring professor; but as events fell out he perhaps did more in the way of important investigations by his unaided and unhurried industry than all his hypothetical students might have accomplished.

The summary of his work in "Who's Who," may be taken as his own estimate of the relative importance of his researches and in it he says :—

> "Has investigated and written papers in the publications of the Royal Society, London, and Royal Society of Edinburgh, on 'Colour and Colour Sensation,' 'Rigidity produced by Centrifugal Force, Dust, Fogs and Clouds,' Colour of Water,' 'Dew,' 'Apparatus for counting the Dust Particles in the

Air,' 'Observations on the number of Dust Particles in the Atmosphere of different places in Europe,' 'Hazing effect of Atmospheric Dust,' 'Cloud Particles,' Cyclones and Anti-cyclones,' 'The Sun as a Fog Producer,' etc. Has invented instruments for counting the dust particles in the atmosphere, chromomictors and the Koniscope."

Probably the name of John Aitken will be associated more particularly with the discovery of the place of dust in the functions of the atmosphere, and to the revision of the theory of dews, but his services to experimental meteorology are much more extensive. His valuable researches on the measurement of air temperature have never been fully appreciated by meteorologists and it is to be feared that they are little known. They deal almost exhaustively with the effect of radiation on thermometer bulbs of different size and surface, with the effect of shelter in thermometer screens, the influence of a current of air flowing over the bulbs and the possibility of securing such a current by the use of a chimney of appropriate size and suitable surface.

At the time of his death Dr. Aitken was studying the grass minimum temperatures recorded in different parts of the country this autumn, and in correspondence with the writer of this notice on the discrepancies between the readings at various London stations, his handwriting was as firm and his grasp of the problems of radiation temperatures as sure as they were forty years ago.

To Dr. Aitken his researches were everything. He shrank from public appearances and had no ambition to take a leading part in the conduct of scientific societies. He was equally indifferent to the conventional opinions which dominate so many scientific workers, and cared little for scientific orthodoxy if the plain leading of observation and experiment ran athwart its canons.

In the days of the Scottish Marine Station and the Ben Nevis Observatory, he co-operated with Dr. Buchan, Sir John Murray, Prof. P. G. Tait, Prof. Chrystal and Sir Arthur Mitchell in promoting research in the deep sea and the upper air at a time when those researches were viewed with profound indifference in most parts of this country, and all that he wrote both in those early days and later is well worthy of attention now when the tide of general interest has been directed into the channels where he was a pioneer.

H.R.M.

METEOROLOGICAL OFFICE FORECAST SERVICE.

On November 18th, the Forecast Branch of the Meteorological Office was removed from Exhibition Road, South Kensington, S.W., 7, to The Air Ministry, Kingsway, W.C. 2.

THE USE OF AEROPLANES IN METEOROLOGY.

By C. K. M. Douglas,
Late Pilot of the R.A.F.

The recent development of the aeroplane has provided a method of upper air research, which has some advantages over any other method, as the instrumental observations may be combined with direct observation of cloud formations. The author took part in upper air observations carried out by aeroplanes at Berck, in north-east France, between February, 1918, and May, 1919, in co-operation with the Meteorological Section, R.E., under the direction of Lt.-Col. Gold, D.S.O., F.R.S., primarily for the artillery, but also as an aid to forecasting. The observations included temperature, humidity, visibility and also observations of cloud forms, assisted by the photographic camera. The results achieved showed what might be accomplished if observations were made regularly at a number of stations.

One result of such observations would be an increased knowledge of cloud formations and of their value in forecasting. The clouds have not hitherto attracted the attention they deserve, among most meteorologists, but the application to forecasting of ordinary observations made with the International code is by no means easy. An experienced observer of clouds and of local weather not infrequently makes a more accurate prediction than the forecaster with a synoptic chart, especially in the remoter districts in the west and north. At the same time the enormous advantage of the synoptic method is obvious, when it is realised that our weather may be completely changed within twenty-four hours as the result of a complex series of causes operating over any or every part of western Europe, the eastern Atlantic and the Arctic Sea. Observations of clouds can only be of value in so far as they can be used in conjunction with other observations and add to our knowledge of the dynamics and physics of the atmosphere. Aeroplane observations of the temperature and humidity of the air, combined with the view of the clouds over a vast area which the observer obtains, provide a means both of adding to our knowledge and of making more use of cloud observations in forecasting. The principal object at which to aim is a clearer understanding of the causes of our various weather phenomena—a most fascinating branch of study.

Even so simple a factor as the vertical stability of the atmosphere is of great importance in connection with thunderstorms and allied phenomena. A necessary factor for thunderstorm development is a large temperature difference between the lower layers and the layer between 10,000 and 15,000 feet. Thunderclouds tower up to great heights, well above 20,000 feet in the case of severe storms. If their growth is checked below 12,000 feet no storm will develop, except perhaps in rare instances when the clouds are very low and

there is a very rapid lapse of temperature in the lower layers. No storm of any severity is probable unless the clouds can grow above 15,000 feet. The actual disturbance originates in the lower layers, and is much affected by local features at the surface; but the favourable condition may exist over a large area, so that thunderstorms may occur in various parts of the country for several successive days, and on another occasion with similar surface conditions they fail to materialise. An unusually violent outburst is usually the result of marked instability, with enough moisture in the lower air to supply the necessary energy.

Figs. 1 and 2 show cumulo-nimbus clouds, with their tops at about 20,000 feet. The first photograph was obtained from 12,000 feet on the evening of July 14th, 1918, and shows a part of a cumulo-nimbus mass which continued for some distance beyond the right of the picture with a typical "anvil" of false cirrus. The part shown in the photograph had recently grown up and was in the transition stage between water-drops and ice-crystals, but it soon afterwards assumed the same appearance as the rest of the anvil (*i.e.*, it consisted of snow). There were extensive low clouds, the day being warm and moist, and the cumulo-nimbus clouds caused heavy rain, but not violent thunder, as there was no marked instability. The thin strips of cloud in the foreground were at 10,000 feet. Fig. 2 shows large cumulus, and cumulus protruding through a layer of cloud at 8,000 feet, the top of the former being at 12,000 feet and of the latter nearly 20,000 feet. There were heavy local showers and a little thunder. The photograph was taken over the sea, looking west, in the evening of September 23rd, 1918, with very low temperature in the upper air, which belonged to a north-west current behind a depression. The base of the clouds was at 2,500 feet, and they easily grew through the layer at 8,000 feet, although the conditions at that particular height were just stable enough to permit of a horizontal sheet of clouds.

It is plainly of great importance to determine the factors which influence the upper air temperature, in order, if possible, to foretell the changes in advance. Mr. W. H. Dines, F.R.S., has shown that the temperature in the upper air is closely related to the pressure, the correlation co-efficients being ·77 at three kilometres, and ·84 at four kilometres.* But these co-efficients, though high, still allow some influence for other factors. The simultaneous observations of wind and temperature in France (some 500 in all) showed that the source of the air supply has a considerable influence on its temperature.

When pressure is low for a few days over Scandinavia and high over, or to the westward of, Iceland, the polar current resulting always causes extremely low upper air temperatures over Britain and north

* Geophysical Memoirs, No. 13.

Fig. 1. July 14th, 1918. Cumulo-nimbus up to 20,000 feet.

Fig. 2. September 23rd, 1918. Large cumulus and cumulo-nimbus, protruding through cloud-sheet.

[Face p. 128.

France. The squally showery weather characteristic of the north-westerly currents is a result of the low upper air temperatures, and the tops of the showers frequently exceed 15,000 feet. When the upper air is in steady horizontal motion it tends to change its temperature very slowly, so that a polar current must be cold. Very often a cold current curves round a depression and arrives from south-west, or even south, and in the same way a warm current may curve round an anticyclone. Once cold air is widespread a change of wind may not produce an immediate effect. The result of these considerations and of the dominant effect of the pressure is that north winds at 10,000 feet (3 kilometres) are only on the average a few degrees colder than south winds. But the extreme variations caused by currents from a very cold or warm source are much greater. When deep depressions are passing some distance to north or north-west, the changes due to a succession of warm and cold currents may amount to 15° or 20° F. at 10,000 feet, and the normal relation between the pressure and the temperature at that level may be reversed for twenty-four or forty-eight hours.

Mr. W. H. Dines attributes the relation between pressure and temperature in the upper air largely to air being transferred from the cyclone to the anti-cyclone (during their development) at about nine kilometres, with the result that the air in the cyclone bulges up and is cooled, while the air in the anticyclone is forced down and dynamically warmed. It is possible to accept this theory and at the same time to stipulate that there are other variations due to the origin of the air supply, as the two factors are independent and their effects may be super-imposed. Even in anticyclones, where the relation between the temperature and pressure in the upper air is normally most perfect, there are variations in the temperature and humidity observed at a single station, which are due to the horizontal rather than to the vertical motion of the air. The air which descends is very dry and its lower limit is usually marked by an inversion, *i.e.*, an abrupt rise of temperature for a few hundred feet. But the level and the magnitude of the inversion may vary considerably in quite a short time, and near the edge of the anti-cyclone it may disappear and then reappear again without much change of pressure. In these conditions the warm dry layers probably travel great distances almost horizontally. Again, warm damp layers may exist at any height in an anticylone, often above a very dry layer, and these layers must owe their warmth to their place of origin, as they cannot have been warmed for some time past. Warm damp layers of great depth, with much medium and high cloud, are often found round the northern boundaries of anti-cyclones, and sometimes in front of depressions. The relation between these warm damp currents and the very cold dry polar currents is a subject of great interest and importance, of which little is yet known. Systematic cloud observations, especially if

combined with regular information of upper air temperatures and humidities, should throw light on the subject.

But we are here concerned less with the forces controlling the large atmospheric movements than with the weather changes resulting therefrom, and their relation to the temperature and cloud distribution in the upper air. These subjects will be further considered in the second half of the article.

(To be continued).

Correspondence.

To the Editor of Symons's Meteorological Magazine.

WIND IN RELATION TO TIDE.

I HAVE read with interest the letter from Mr. Twist in the October number of *Symons's Meteorological Magazine* on "Wind in relation to tide," and note that he invites opinions and experiences.

For several years I was a lighthouse keeper at the Chapman lighthouse, situated near Southend, and took particular notice of the winds and tides.

I am inclined to the opinion that the tides do have some influence on the wind, but not to the extent which most fisherfolk will claim for them. For instance, in heavy winds I have repeatedly noticed that no difference of direction or force could be observed, but, on the other hand, with light winds (from force 3 to 6) I have often observed an increase of force with the flood tide with a westerly wind and a decrease of force with the ebb tide; and the reverse for an east wind. I have mentioned this to the mate of the Nore lightship, and he fully agreed with the foregoing statement, and added, that his experience, speaking generally for the English coasts was, that any wind increases with the tide running to windward, and decreases with the tide in the direction of the wind.

At the Chapman lighthouse, I endeavoured to make a tangible statement concerning the direction of wind in relation to tide, but gave it up as hopeless, because the wind's direction would repeatedly change at any state of the tide from high to low water. However, fisherfolk and 'longshoremen will say, the direction of the wind will change under such and such conditions of tide and wind.

GEO. E. DANES.

58, Upperton Road, Plaistow, E. 13., 7th November, 1919.

LIGHTNING FIGURES.

DR. NEWELL'S note in the October number, on "tree markings," on the body of a man killed by lightning, recalled to me a paper by Mr. Symons in *Meteorological Magazine*, vol. **18**, pp. 81 seq., in which, after having cited numerous similar instances, and described a photograph of a then recent case, he came to the conclusion that the markings were "not referable either to a tree, or to photographic action, but simply to the well known ramification of an electric discharge." As in one instance given one person struck was within a stable, while his companions were outside and all were marked alike, and another occurred on open ground, where there was no tree near, his first conclusion seems inevitable.

This paper was followed on pp. 104, seq, by another, from Prof. Tomlinson, who had read a paper on the subject before the British Association in 1861, and while agreeing with Mr. Symons as to the mode of production of the marks, differed in some details. A further note from Mr. Strachan appeared on p. 120.

I need not do more than give your readers these references, which will show that so far from this phenomenon being unusual, it is of not infrequent occurrence, and is well authenticated.

JAMES G. WOOD.

115, Sutherland Avenue, W. 2, November, 1919.

THE INTENSE FROST OF NOVEMBER, 1919.

A SPELL of severe winter cold in November, like a spell of hot summer weather in the oppositely-placed month of May, is one of the most constant features of the English climate.

In the north of England and Scotland skating-frosts and deep snows in November are common enough, and quite recent years, 1909, 1912 and 1915 were prominent examples. The recent spell of Arctic November weather with minima in Scotland approximating to 0° F. and maxima in places below 20° was chiefly remarkable in this: that its intensity was unusual not only for the *first half* of November, but even for January or February, and it only shows what may be expected given the right conditions of air circulation in the high latitude of Scotland during the period of the low solstice. It is interesting to note, too, that the advance guard of this November invasion of cold arrived as far back in the autumn as the third week in September—around the 20th, when we experienced in a manner far more drastic than usual one of these cold draughts from the polar regions which occur every September as a sure indication of the passing of summer. It will be recalled, also, that October, 1919, was prevailingly bleak and frosty.

L. C. W. BONACINA.

27, Tanza Road, Hampstead, N.W. 3, November 30th, 1919.

SNOW FOLLOWING FINE WEATHER.

In my note to you of March 5th I did not say the above but "A glorious soft warm sunny day, a striking contrast to the previous weather," etc.

Mr. ffarington's tables do not therefore apply. On looking back, I find :—

In 1912—No days answering that description.
1913— " " " "
1914— " " " "
1915—March 6—Very soft and warm, maximum, 55°.
" 8—Bitterly cold hard N.E. wind, particles of snow.
1916— " 18—Lovely calm day, best this year, maximum, 54°.
" 21—Rain all day, turning to snow in the evening.
1917— " 17—Lovely day, first spring day, maximum, 54°; first with maximum above 50° since January 2nd.
" 20—Heavy snow, 7—10.30 a.m.
1918—Feb. 23—Lovely warm spring day. No snow followed directly, but a hard bitter N. wind and on the 28th, snow, with wintry weather.

At any time of the year a cold snap is often ushered in, as it were, by a short spell of extra warmth, and *per contra*, the hardest frosts, often occur just before a thaw. There must be some atmospheric condition to account for these facts. CHARLES P. HOOKER.

Cirencester, September, 28th, 1919.

ROYAL METEOROLOGICAL SOCIETY.

The first ordinary meeting of the session was held on November 19th, in the Society's rooms, 70, Victoria Street, S.W., Mr. F. J. W. Whipple, Vice-President, in the chair.

Lieut. C. W. B. Normand, of the Indian Meteorological Service, read a paper on the "Effect of high temperature, humidity and wind on the human body." The climatic conditions under which a wet bulb restricted to a certain maximum rate of evaporation and having an initial temperature of 36°·5 C., will neither gain nor lose heat were derived from kata-thermometer and wet-bulb formulæ. The application of these results to the human body was considered, and on the assumption that conditions resulting in a rise of body temperature above 36°·5 C. must be fatal, the upper limits to climatic conditions under which human life was possible were deduced. The scorching and sometimes deadly simoom of tropical deserts was considered to be a case of the onset of a high wind, without necessarily a change of temperature or humidity

converting livable into unlivable conditions. The suggestion was made that an essential feature of heats-trokes may be that a portion of the body has been exposed for a time to air conditions which are above the limit for existence. The wet kata-thermometer and wet-bulb formulæ were found to furnish quite discordant results regarding the behaviour of a wet surface under varying wind velocities and it was suggested that this discrepancy was due to a less efficient wetting of the kata-thermometer bulb and to a consequently restricted rate of evaporation from it.

Dr. Leonard Hill thought that the discordancy between the wet-kata and the wet bulb thermometers was more probably due to sheltering effects than to drying. He believed heat-stroke was caused by fatigue of the sweat glands. In hospitals in Mesopotamia many lives had been saved by covering the patients with wet sheets, which were fanned in order to set up artificial perspiration. He urged the need of further observations and experiments. Captain Evans, R.A.M.C., said his Persian servant had told him that the most effective way to withstand the effects of the simoom was to lie down, burying the hands and face under the clothing, thus shielding the body from the wind, the effect of which was more disastrous than the high temperature. The critical temperature for heat-stroke might vary from 105° to 120° F., or even more, in different individuals. He knew cases where patients suffering from heat-stroke had completely recovered from a body temperature of 110° and some had stood 111° with impunity. Lieut.-Col. Martin Flack said that the keynote to perfect health was great vital capacity. A man with good respiratory force got plenty of lung evaporation. A stuffy atmosphere and sendentary life brought about poor evaporatory force and poor vital capacity.

Capt. A. J. Bamford read a paper on "Some observations of the upper air over Palestine." The observations were all made during the last two years. Tables and graphs showed the monthly averages of the horizontal movements at different altitudes over three stations, at one of which (near Ramleh) observations were kept up continuously for a year. Attention was called to the agreement between the results found and the general summary in Prof. Hildebrandsson's "*Mouvements généraux de l'atmosphère.*" These flights were observed for the first few (usually fifteen) minutes with two theodolites, or a theodolite and a range-finder, the upper part of each ascent being observed with a theodolite alone. The paper also dealt with vertical velocities and included frequency curves, showing for each of the layers, 0-2000, 2000-4000, 4000-6000 feet, the number of times in each month that the observed velocities differed from the theoretical ones by not more than 10, 20, 30 or 40 per cent. etc. The lowest layer was appreciably the most varied, and in it differences of 50 per cent. were not unusual, although the average velocity differed very slightly from theory. In the other

layers there was a distinct increase in the compactness of the frequency curves, while the average velocity changed from slightly above to slightly below the theoretical value.

Mr. J. S. Dines said the correctness of the formula given depended on the size of the balloons. He had found that large balloons went up faster than small ones. Mr. F. J. W. Whipple remarked upon the reversal of the north-south component at 10,000 feet. Captain Pick asked if the author had discovered any general rule by which the wind at 3,000 feet could be deduced from that at 500 feet. On the western front there was a persistent westerly drift between 20,000 and 30,000 feet and it would be interesting to know if this feature was observed in Palestine. He suggested deducing temperature gradients from a correlation of surface temperatures with sky face.

A paper by Mr. E. J. Bilham, B.Sc., was entitled "Barometric pressure and underground water-level." The results recently obtained from a study of an experimental wall with autographic registration at Kew Observatory, Richmond, Surrey, were compared with some earlier records obtained by Dr. Isaac Roberts at Maghull, near Liverpool, and by Prof. K. Honda in the neighbourhood of Tokyo, in Japan. As at Kew, the sensitiveness of the water surface at Maghull to pressure changes varied considerably, high sensitiveness being associated with saturation of the soil by previous heavy rainfall. In Japan it was found that in surface wells the water level was not affected by pressure changes, sensitiveness being exhibited by deep artesian wells only. Prof. Honda had pointed out that by determining the sensitiveness of a well to barometric pressure, the extent to which pressure changes affect strata at a given depth below the surface can be deduced. Data for Japan and the British Isles obtained in this way showed marked points of difference.

The following candidates were balloted for and elected fellows of the Society :—Mr. W. Andrews, Lt. C. A. Brook, R.A.F., Capt. R. A. Cochrane, R.A.F., Mr. J. L. Copp, Mr. F. Cruickshank, Capt. I. G. Le R. Diamond, Capt. C. K. M. Douglas, Lt. C. W. Duffield, Lt. F. J. Goodfellow, Mr. R. F. T. Granger, Flt.-Lt. S. B. Holloway, Flt.-Lt. T. C. B. Hooke, Lt. A. W. Isherwood, Mr. W. C. Kaye, Mr. E. W. Kitchin, C.E., Mr. R. Knight, Dr. V. F. V. Lindholm, Dr. S. F. Linton, Lt. A. W. Mackay, Mr. D. J. Mares, Mr. S. Mortimer, Mr. W. B. Murphy, Mr. F. H. Newman, Dr. V. V. Pamana-Sastrin, Lt. R. Stewart and Mr. T. J. Williams.

REVIEWS.

The Study of the Weather. By E. H. CHAPMAN, M.A., B.Sc. Cambridge University Press. Large crown 8vo., pp. xii. + 132. Illustrated. Price, 3s. 6d. net.

MR. CHAPMAN combines the practical experience of the meteorologist, having served on the western front as meteorological officer to the Fifth Army, with a knowledge of just what the schoolmaster wants. The latest volume of the Cambridge "Nature Study Series," is an admirable introduction to the study of meteorology, and should be useful in stimulating interest in the subject wherever it forms part of the school curriculum. From the selection and orientation of an observation post the student is taught to make weather observations, to study cloud forms and sky signs, and to record instrumental observations. The principle and construction of the rain gauge, thermometer and barometer are explained with the aid of laboratory apparatus. It is to be regretted that the author advocates the use of a home made rain gauge constructed to a bad design, which would certainly give rise to loss by outsplashing and failure to catch snow. The construction of weather charts is explained simply, and the cyclone and anticyclone are described. The last chapter introduces the absorbing subject of weather forecasting. Exercises and problems of a varied character are continuously presented to the scholar and the value of the volume is enhanced by many excellent maps and illustrations.

H.E.C.

Principles of Meteorology. By Capt. G. Ota. Tokyo, 1919. Pp. 12 and 5 plates.

CAPT. G. OTA knows all about meteorology. He says so. "I have found the principles and origins of the phenomena of meteorology and that will explain enough all ambiguous points of meteorology." This book appears to be the fruits of twenty years' study as a mariner who has "navigated to and fro nearly every sea." It consists of but twelve slender pages (giving an allowance of about sixteen lines of letterpress per year of experience).

"Spiral ascendant currents" are to Captain Ota what King Charles's head was to Mr. Dick—as David Copperfield says of this, in regard to the memorial, "I thought I saw some allusion to it in one or two places."

The conclusion is all-sufficient, "There is no meteorological phenomenon, but that caused by the spiral ascendant currents, which cause nearly all of clouds, thunder, rain, fog, etc., or they are the part of the spiral ascendant currents. This theory explains every ambiguos (*sic*) meteorological question quite plain."

The illustrations are referred to as "imaginary plans," a truly happy description.

C.S.

METEOROLOGICAL NEWS AND NOTES.

DR. C. CHREE, F.R.S., has been awarded the Hughes Medal of the Royal Society.

SIR NAPIER SHAW will deliver a course of nine lectures on "A General Survey of the Globe and its Atmosphere," at the Meteorological Office, at 3 p.m. on Fridays, beginning on January 23rd. Admission is free.

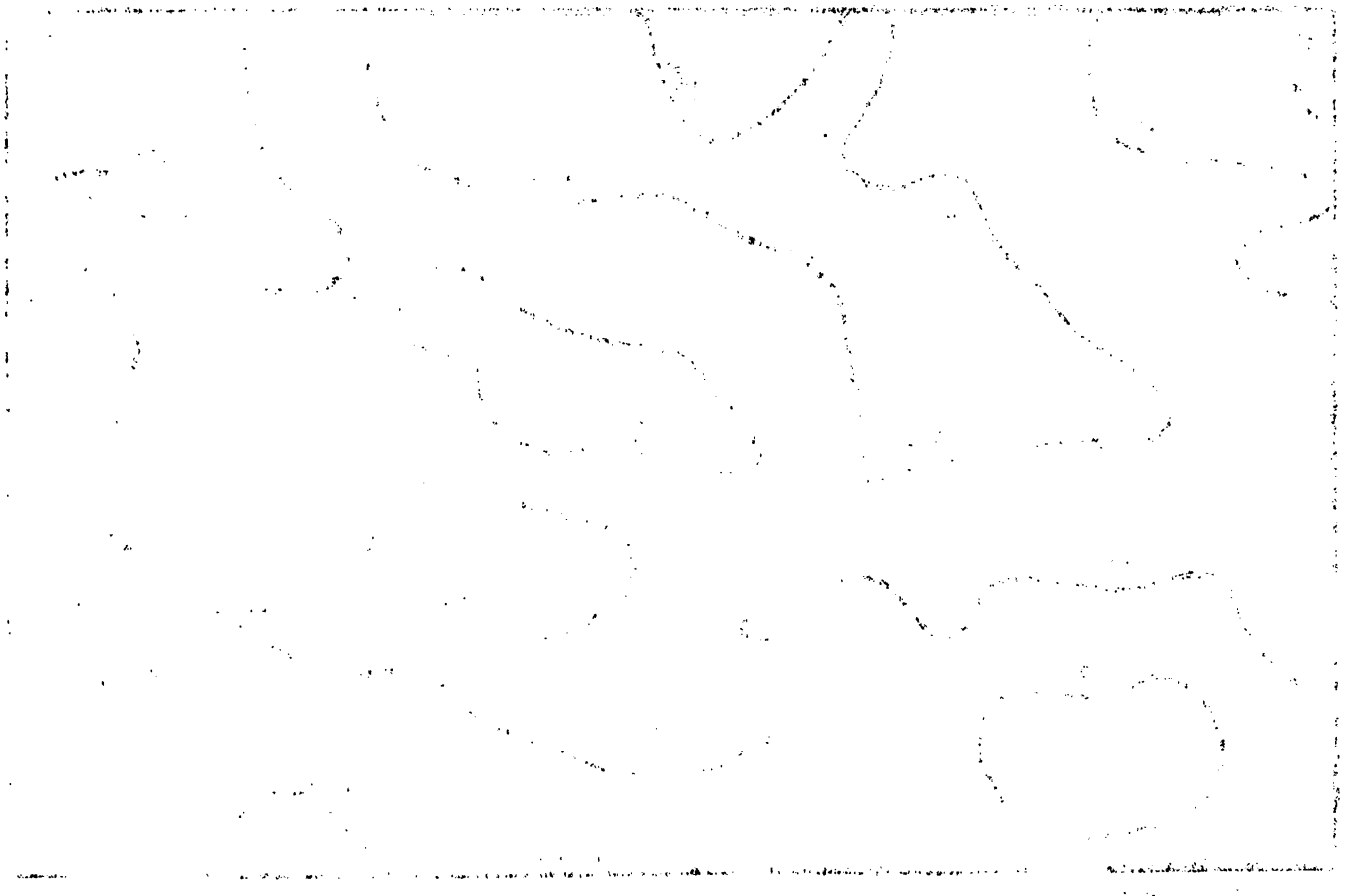
THE SYMONS GOLD MEDAL for 1920, has been awarded by the Council of the Royal Meteorological Society to Dr. H. H. Hildebrandsson, of Upsala University, in recognition of his distinguished work in connection with meteorological science.

METEOROLOGICAL OFFICE APPOINTMENTS.—The following appointments are notified. Major C. P. Hearle, as Superintendent to establish a meteorological station at Malta. Comm. L. A. Brooke-Smith, R.D., R.N.R., as Superintendent of the Marine Division. Mr. J. S. Dines, as Superintendent in charge of forecasting at headquarters.

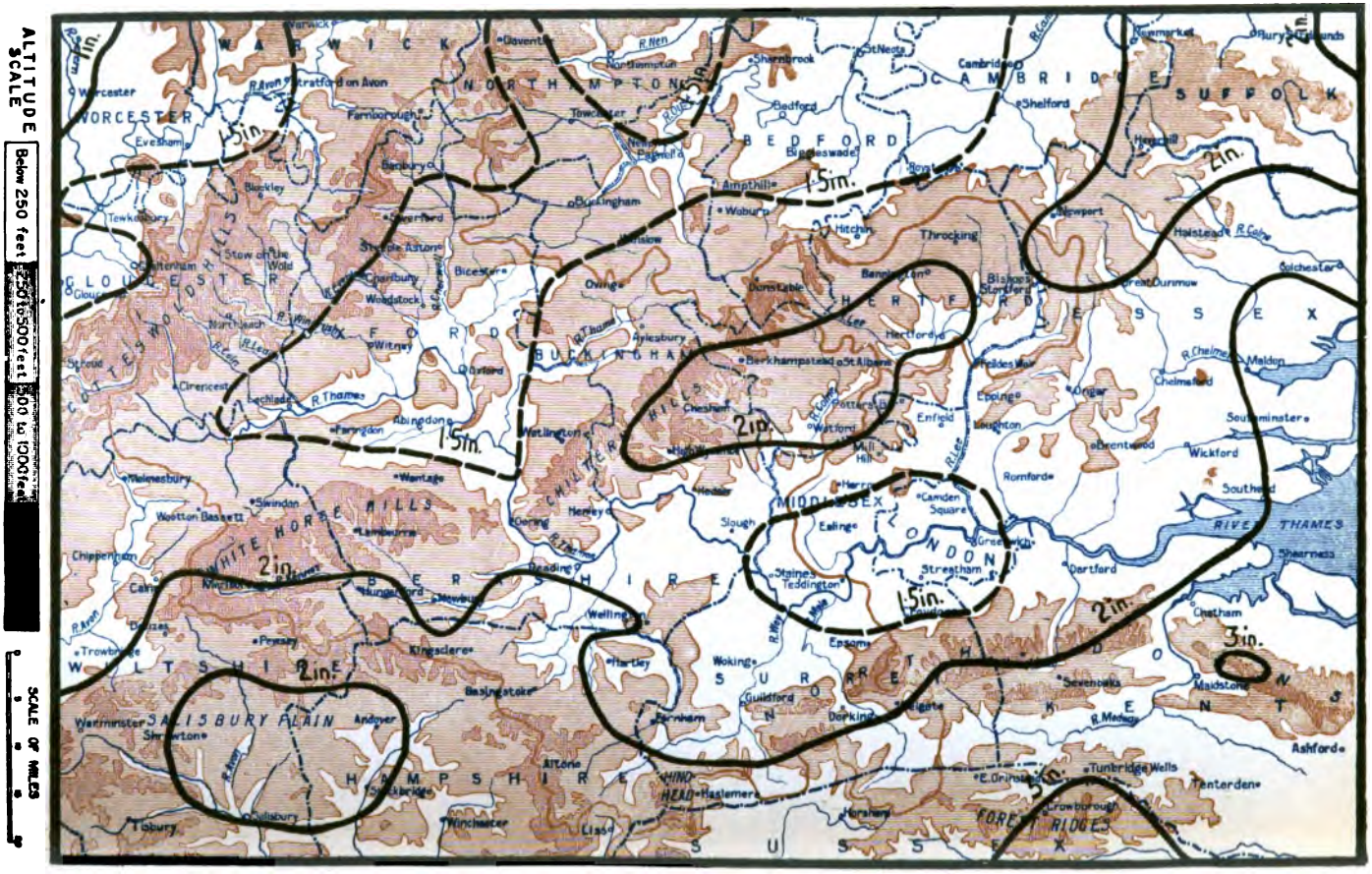
MEETINGS AT THE METEOROLOGICAL OFFICE.—On page 106 of the October number of this magazine the dates of informal meetings at the Meteorological Office for the discussion of contributions to current meteorology in colonial and foreign journals were inadvertently given erroneously. The correct dates during 1920 are January 12th and 26th, February 9th and 23rd, and March 8th and 22nd.

THE CONGRESS OF DIRECTORS of Independent Meteorological services recently decided at Paris, by a majority, that the millibar should be adopted in preference to the millimetre of mercury for use in stating the pressure of the atmosphere.

The Directors of Science in Congress assembled,
Agreed that in future no discord should mar
The values of pressure so often dissembled
By units derived from a platinum bar.
The inch and the metre and gravity trembled,
As into the Congress there tripped lightly skipping
An innocent damsel who'd just 'scaped a whipping;
Her name in plain English was Miss Milly Barr.
Dear Milly Barr
Bjerknesian star;
A thousand of you
Shall be ever our cue,
As our standard of pressure wherever we are. E.G.



THAMES VALLEY RAINFALL. NOVEMBER. 1919.



THE WEATHER OF NOVEMBER.

THE most prominent feature was the unusually severe frost which prevailed in and around the second week, when the majority of places in North Britain recorded temperatures which had not hitherto been observed in November for at least half a century. The month opened with cold easterly and north-easterly winds, but it was not until after the 7th or 8th that the thermometer descended to an exceptionally low level. The sharpest frosts appear to have occurred between the 12th and 15th, when the sheltered thermometer fell slightly below 20° over Eastern and Central England, below 15° at many stations in the western parts of the United Kingdom, and below 10° in Scotland. On the night either of the 13th or 14th a minimum reading of 8° was recorded at Nairn, and 6° at Crieff, while at Balmoral and West Linton the thermometer in the screen recorded 6° below zero F., the minimum on the grass at the former station being 6° below the shade temperature. At many places in the inland parts of Scotland the thermometer on the 14th and 15th remained at least 5° below freezing point all day, and at Balmoral the maximum reading on the 14th was only 10°. The weather during this very cold period was at first fairly dry, but with the advance of a complex cyclonic disturbance, which drifted slowly eastward across the British Isles, snow or sleet fell in all districts; in Scotland the depth of snow in level places was over 6 inches, and at Balmoral as much as 17 inches. Thunder and lightning occurred in the north of Ireland on the 7th and 8th.

The bitter wintry weather was due largely, if not primarily, to the presence of an area of high barometric pressure over the Icelandic region. After the middle of the month, when depressions began to appear in the far north the conditions resumed a more normal character, and, with a shift of wind to the west, temperature rose gradually, but very decidedly. Between the 17th and 19th, and again between the 22nd and 24th, shade maxima exceeding 50° were recorded in most districts, and on the 23rd the thermometer in many places rose considerably above 55°, a reading of 63° being observed at Killarney. In the third week heavy rain fell in Scotland, and on the 20th thunderstorms occurred in Lancashire and North Wales. Towards the close the wind veered, first to the north-west and afterwards to the north, and the weather again became cold, with snow or sleet in several places, and thunderstorms on the 28th in the south-west of England.

The total duration of bright sunshine was in excess of the average in most of the western and northern districts; elsewhere there was as a rule, a slight deficiency.

The rainfall of the month was irregularly distributed, being little more than half the average over a portion of the Thames Valley and in the south of Ireland, but approaching twice the average in the north-east of England, Berwickshire and Aberdeenshire. Rather less than an inch fell in the Upper Severn Valley and less than 2 inches over nearly the whole of the Midland and south-eastern counties, the total rising to more than 6 inches in isolated parts of the Devon-Cornwall peninsula, over a large portion of Wales, and in the Lake District where several stations had more than 10 inches. Over Scotland the normally dry areas in the east showed the greatest excess over the average. Only a small strip bordering the Solway Firth had less than 3 inches, and the greater part of Scotland had more than 5 inches. In part of the Highlands the total reached 8 inches. Over Ireland a large area had less than 2 inches. Elsewhere from 2 to 4 inches fell, except in the west and north where several stations had 6 inches; 8 inches was exceeded in the mountains of Connemara. The general rainfall expressed as a percentage of the average was as follows: England and Wales, 82; Scotland, 110; Ireland, 79; British Isles, 91.

In London (Camden Square) the mean temperature was 38°·9, or 4°·6 below the average. Duration of rain 56·8 hours. Evaporation ·08 inch. Taken together October and November had a mean temp. of 42°·3, the lowest in the 62 years' record, the nearest approach being 43°·1 in 1887.

RAINFALL TABLE FOR NOVEMBER, 1919.

STATION.	COUNTY.	RAINFALL. Aver. 1875–1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·34	1·38	— ·96	59	·22	30	23
Tenterden	*Kent*	3·07	2·23	— ·84	73	·38	28	24
Arundel (Patching)	*Sussex*	3·54	2·00	—1·54	56	·38	28	17
Fordingbridge (Oaklands)	*Hampshire*	3·41	2·27	—1·14	67	·54	30	18
Oxford (Magdalen College)	*Oxfordshire*	2·25	1·16	—1·09	52	·31	30	19
Wellingborough	*Northampn*	2·22	1·32	— ·90	59	·36	2	20
Bury St. Edmunds (Westley)	*Suffolk*	2·40	2·21	— ·19	92	·43	17	21
Geldeston [Beccles]	*Norfolk*	2·49	2·07	— ·42	83	·38	2	19
Polapit Tamar [Launceston]	*Devon*	4·07	5·53	+1·46	136	1·12	9	21
Rousdon [Lyme Regis]	,,	3·51	2·47	—1·04	70	·65	30	18
Ross (Birchlea)	*Herefordshr.*	2·77	1·36	—1·41	49	·33	28	21
Church Stretton (Wolstaston)	*Shropshire*	2·94	1·49	—1·45	51	·25	24	20
Boston	*Lincoln*	2·05	2·09	+ ·04	102	·33	3	23
Worksop (Hodsock Priory)	*Nottingham*	1·98	1·65	— ·33	83	·31	3	24
Mickleover Manor	*Derbyshire*	2·21	2·25	+ ·04	102	·40	17	20
Congleton (Buglawton Vic.)	*Cheshire*	2·61	2·27	— ·34	87	·65	17	24
Southport (Hesketh Park)	*Lancashire*	3·16	2·20	— ·96	70	·41	16	16
Wetherby (Ribston Hall)	*York, W.R.*	2·34	1·97	— ·37	84	·57	16	...
Hull (Pearson Park)	,, *E.R.*	2·34	2·98	+ ·64	127	·45	3	27
Newcastle (Town Moor)	*North'land*	2·63	4·48	+1·85	170	·44	9	27
Borrowdale (Seathwaite)	*Cumberland*	13·59	11·70	—1·89	86	...	...	...
Cardiff (Ely)	*Glamorgan*	4·08	3·89	— ·19	95	·81	30	21
Haverfordwest	*Pembroke*	5·16	3·32	—1·84	64	...	...	17
Aberystwyth (Gogerddan)	*Cardigan*	4·50	...	...	...	...	...	..
Llandudno	*Carnarvon*	3·19	1·86	—1·33	58	·28	19	19
Cargen [Dumfries]	*Kirkcudbrt.*	4·35	3·51	— ·84	81	·39	11*	18
Marchmont House	*Berwick*	3·21	6·27	+3·06	195	1·04	25	24
Girvan (Pinmore)	*Ayr*	5·24	4·48	— ·76	86	·70	30	17
Glasgow (Queen's Park)	*Renfrew*	3·63	4·64	+1·01	128	·95	18	16
Islay (Eallabus)	*Argyll*	5·33	5·47	+ ·14	103	·89	23	18
Mull (Quinish)	,,	6·24	4·77	—1·47	76	·64	17	17
Loch Dhu	*Perth*	8·36	7·05	—1·31	84	1·00	16	16
Dundee (Eastern Necropolis)	*Forfar*	2·62	4·77	+2·15	182	·90	23	23
Braemar	*Aberdeen*	3·76	6·25	+2·49	166	·90	9	20
Aberdeen (Cranford)	,,	3·29	5·33	+2·04	162	1·11	7	23
Gordon Castle	*Moray*	2·85	4·51	+1·66	158	...	...	...
Drumnadrochit	*Inverness*	3·41	4·44	+1·03	130	·80	26	17
Fort William	,,	7·55	6·69	— ·86	89	1·25	17	19
Loch Torridon (Bendamph)	*Ross*	8·90	6·54	—2·36	73	1·15	17	16
Dunrobin Castle	*Sutherland*	3·25	4·27	+1·02	131	·75	18	15
Glanmire (Lota Lodge)	*Cork*	4·45	2·25	—2·20	51	·73	30	13
Killarney (District Asylum)	*Kerry*	5·54	3·97	—1·57	72	·70	9	16
Waterford (Brook Lodge)	*Waterford*	3·80	1·63	—2·17	43	·50	30	16
Nenagh (Castle Lough)	*Tipperary*	3·88	2·53	—1·35	65	·49	24	14
Ennistymon House	*Clare*	4·62	3·49	—1·13	76	·54	19	16
Gorey (Courtown House)	*Wexford*	3·41	3·33	— ·08	98	·82	28	22
Abbey Leix (Blandsfort)	*Queen's Co.*	3·28	1·79	—1·49	55	·44	30	17
Dublin (Fitz William Square)	*Dublin*	2·64	3·01	+ ·37	114	·60	14	22
Mullingar (Belvedere)	*Westmeath*	3·38	1·89	—1·49	56	·37	9	15
Crossmolina (Enniscoe)	*Mayo*	5·75	5·62	— ·13	98	·70	8	20
Cong (The Glebe)	,,	5·00	...	...	...	...	...	...
Collooney (Markree Obsy.)	*Sligo*	4·02	4·21	+ ·19	105	·83	25	18
Seaforde	*Down*	3·86	2·48	—1·38	64	·56	30	16
Ballymena (Harryville)	*Antrim*	3·95	3·93	— ·02	99	·78	23	19
Omagh (Edenfel)	*Tyrone*	3·66	4·42	+ ·76	121	·90	23	20

*17 & 30.

SUPPLEMENTARY RAINFALL, NOVEMBER, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Sevenoaks, Speldhurst Close.	2·38	XI.	Lligwy	2·59
,,	Ramsgate	3·65	,,	Douglas, Isle of Man	...
,,	Hailsham	4·24	XII.	Stoneykirk, Ardwell House...	3·47
,,	Totland Bay, Aston House...	2·10	,,	Carsphairn, Shiel	6·33
,,	Stockbridge, Ashley..	2·00	,,	Langholm, Drove Road	4·97
,,	Grayshott	2·30	XIII.	Selkirk, The Hangingshaw..	4·63
,,	Upton Nervet	1·92	,,	North Berwick Reservoir	5·32
III.	Harrow Weald, Hill House...	1·80	,,	Edinburgh, Royal Observaty.	4·99
,,	Pitsford, Sedgebrook	1·57	XIV.	Biggar	4·07
,,	Woburn, Milton Bryant	1·61	,,	Maybole, Knockdon Farm ...	3·37
,,	Chatteris, The Priory	1·50	XV.	Shiskine	4·08
IV.	Elsenham, Gaunts End	2·43	,,	Ardgour House	9·06
,,	Rayleigh	1·55	,,	Oban	5·68
,,	Colchester, Hill Ho., Lexden	1·70	,,	Holy Loch, Ardnadam	5·32
,,	Aylsham, Rippon Hall	3·09	,,	Loch Venachar	4·80
,,	Swaffham	2·61	XVI.	Glenquey	5·80
V.	Bishops Cannings	2·39	,,	Loch Rannoch, Dall	5·70
,,	Weymouth	2·96	,,	Aberfeldy, Dunros	5·15
,,	Ashburton, Druid House	5·43	,,	Coupar Angus	4·29
,,	Cullompton	2·55	,,	Montrose, Sunnyside Asylum.	3·98
,,	Lynmouth, Rock House	4·02	XVII.	Balmoral	5·85
,,	Okehampton, Oaklands	...	,,	Fyvie Castle	4·78
,,	Hartland Abbey	3·67	,,	Keith Station	5·78
,,	St. Austell, Trevarna	4·86	XVIII.	Rothiemurchus	...
,,	North Cadbury Rectory	2·42	,,	Loch Quoich, Loan	14·25
VI.	Clifton, Stoke Bishop	1·99	,,	Skye, Dunvegan	5·96
,,	Ledbury, Underdown	1·44	,,	Fortrose	3·65
,,	Shifnal, Hatton Grange	1·57	,,	Glencarron Lodge	7·40
,,	Droitwich	·83	XIX.	Tongue Manse	6·56
,,	Blockley, Upton Wold	1·78	,,	Melvich	6·41
VII.	Grantham, Saltersford	1·92	,,	Loch More, Achfary	10·00
,,	Louth, Westgate	2·56	XX.	Dunmanway, The Rectory	3·22
,,	Mansfield, West Bank	2·21	,,	Mitchelstown Castle	2·32
,,	Derby, Midland Railway	1·77	,,	Gearahameen	6·20
VIII.	Nantwich, Dorfold Hall	2·04	,,	Darrynane Abbey	3·56
,,	Bolton, Queen's Park	4·03	,,	Clonmel, Bruce Villa	1·85
,,	Lancaster, Strathspey	2·43	,,	Roscrea, Timoney Park	1·55
IX.	Langsett Moor, Up. Midhope	3·39	,,	Broadford, Hurdlestown	2·64
,,	West Witton	3·69	XXI.	Enniscorthy, Ballyhyland...	...
,,	Scarborough, Scalby	4·07	,,	Rathnew, Clonmannon	3·75
,,	Ingleby Greenhow	3·50	,,	Hacketstown Rectory	2·12
,,	Mickleton	3·57	,,	Ballycumber, Moorock Lodge	1·64
X.	Bellingham, High Green Manor	6·11	,,	Balbriggan, Ardgillan	2·12
,,	Ilderton, Lilburn Cottage	5·69	,,	Castle Forbes Gardens	2·14
,,	Keswick, The Bank	3·92	XXII.	Ballynahinch Castle	4·55
,,	Orton	6·12	,,	Woodlawn	2·75
XI.	Llanfrechfa Grange	2·61	,,	Westport House	5·18
,,	Treherbert, Tyn-y-waun	6·04	,,	Dugort, Slievemore Hotel	...
,,	Carmarthen, The Friary	3·24	XXIII.	Enniskillen, Portora	3·45
,,	Fishguard, Goodwick Station.	3·03	,,	Dartrey [Cootehill]	2·05
,,	Crickhowell, Tal-y-maes	6·50	,,	Warrenpoint, Manor House	2·03
,,	Birmingham WW., Tyrmynydd	4·93	,,	Belfast, Cave Hill Road	3·94
,,	Lake Vyrnwy	4·55	,,	Glenarm Castle	4·12
,,	Llangynhafal, Plas Drâw	2·70	,,	Londonderry, Creggan Res...	4·44
,,	Rhiwbryfdir	5·86	,,	Milford Manse	5·25
,,	Dolgelly, Bryntirion	4·59	,,	Killybegs	7·09

Climatological Table for the British Empire, June, 1919.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	84·9	11	41·0	27	72·3	50·7	49·2	63	127·0	36·5	1·51	9	5·4
Malta	95·0	24	61·0	1, 2	80·6	65·9	...	79	144·0	...	·00	0	3·5
Lagos	87·3	2	71·0	21	84·3	74·7	73·6	80	157·3	60·0	8·31	14	7·6
Cape Town	75·9	2	37·1	28	64·1	49·6	50·2	80	...	...	2·99	12	5·6
Johannesburg	73·2	26	36·4	10	62·9	42·9	35·6	62	...	29·3	·00	0	2·4
Mauritius	79·2	13	58·5	19	76·8	64·8	62·8	78	..	52·5	2·36	10	6·4
Bloemfontein	73·9	7	24·3	22	65·3	36·4	34·2	65	...	...	·00	0	3·0
Calcutta...	100·6	2	75·2	1	89·9	79·1	78·4	86	...	71·5	12·94	15	7·0
Bombay	94·0	2	75·6	26	88·4	80·6	77·5	81	134·8	71·3	23·35	20	7·6
Madras	105·0	18	70·2	3	98·8	80·0	70·3	61	159·1	70·5	2·49	12	7·1
Colombo, Ceylon ...	87·7	2, 3	73·7	28	85·9	77·9	75·0	82	151·9	72·0	3·59	19	8·3
Hongkong	90·6	26	76·2	1	87·0	79·4	76·8	83	...	...	10·82	17	7·4
Melbourne	67·2	1	35·0	4	57·1	44·2	42·4	72	106·6	29·0	1·25	15	6·0
Adelaide	72·1	8	38·6	24	63·6	48·6	47·2	72	127·0	27·3	1·78	14	5·5
Perth	79·2	4	39·4	18	64·6	49·1	...	...	129·7	30·7	5·69	16	5·7
Coolgardie	74·8	5	35·8	21	63·6	44·5	42·0	60	132·8	33·2	1·07	3	5·0
Brisbane	77·1	16	43·4	20	69·0	53·6	50·9	68	128·9	32·0	·78	11	4·4
Hobart, Tasmania ..	64·5	1	33·4	30	53·9	43·2	38·8	66	105·7	26·8	3·28	19	6·7
Wellington ...	65·9	12	29·9	1	54·9	43·0	42·5	79	114·0	...	2·44	15	5·2
Jamaica, Kingston ..	92·1	10	72·2	25	88·8	74·4	72·0	77	...	...	·45	3	5·6
Grenada	87·0	4	72·0	8	84·0	75·0	...	76	134·0	...	4·39	18	5·0
Toronto	94·4	14	47·2	28	83·4	61·3	60·2	70	129·9	43·2	2·72	8	2·9
Fredericton	90·0	6	30·0	1	75·4	48·0	52·4	65	...	...	2·33	6	3·7
St. John, N.B. ...	83·5	4	37·3	1	64·7	47·6	48·2	76	132·6	33·7	2·90	10	5·0
Victoria, B.C.	70·0	12	42·8	7	61·8	46·9	45·0	73	137·0	36·0	·53	7	4·6

Johannesburg.—Bright sunshine, 260·0 hours.

Mauritius.—Mean temp. 1°·1 above, dew point 1°·6 above, relative humidity 1·3 above, and R ·43 in. below, averages.

COLOMBO, CEYLON.—Mean temp. 0°·3 above, dew point 0°·3 below, and R 3·72 in. below, averages. Mean velocity of wind 6·6 miles per hour, prevailing direction W.S.W.

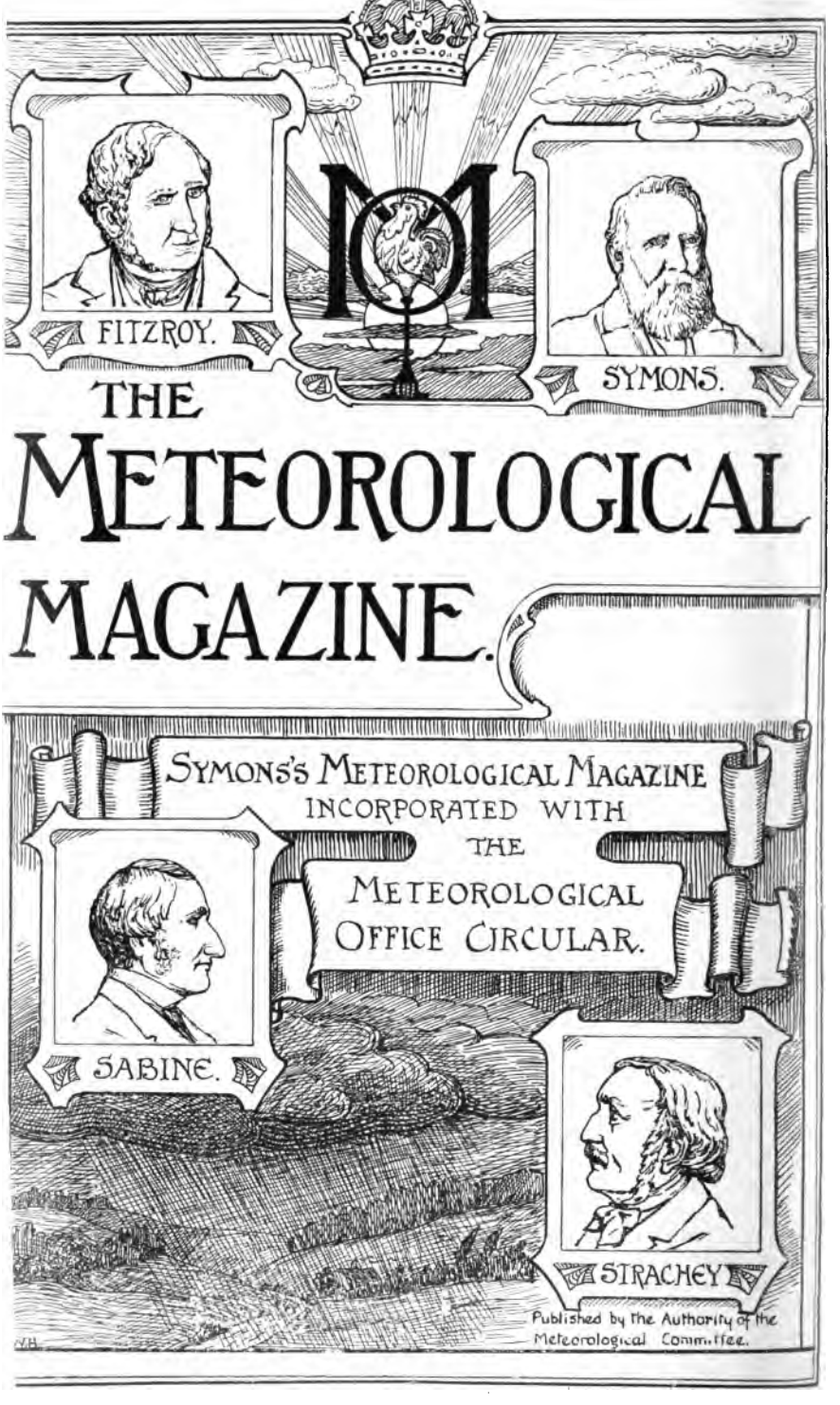
HONGKONG.—Bright sunshine, 203·5 hours. Mean velocity of wind 8·4 miles per hour, prevailing direction S. Mean temperature 82°·6.

Adelaide.—R 1·31 in. below normal.

Perth.—R 1·32 in. below normal.

Coolgardie.—R 0·17 in. below normal.

Wellington.—Bright sunshine 134·3 hours. R 2·62 hours below average.



Design for Cover of "THE METEOROLOGICAL MAGAZINE."
Drawn by MR. W. HAYES.

Symons's Meteorological Magazine.

No. 648. JANUARY, 1920. Vol. LIV.

SYMONS'S METEOROLOGICAL MAGAZINE.

The present number completes Volume **54** of *Symons's Meteorological Magazine*, and marks also the end of a phase in its long history. Founded in 1866 by the late Mr. G. J. Symons as a means for the prompt publication of rainfall statistics for the British Isles, in continuation of the "Rainfall Circulars" issued for two or three years previously, the Magazine rapidly extended its scope to embrace the whole field of meteorological science. Although circulating in all parts of the world, *Symons's Meteorological Magazine* has always kept to its founder's original aim of being primarily the organ of the British Rainfall Organization and as such the medium for the discussion of meteorological matters from the point of view of the large body of volunteer Observers who have given British Climatology such a unique character.

Throughout the greater part of its career there can be no question that the Magazine has carried out this object the more effectively by being entirely under the personal control of its successive editors. It played a large part in bringing into being and encouraging the corps of voluntary meteorological Observers in the British Isles, and that in the course of time official meteorology in this country came to build largely upon this firm foundation is a tribute to the foresight and wisdom with which Mr. Symons shaped his policy.

In July, 1919, when the British Rainfall Organization became part of the official meteorological service of Great Britain, the continuance of this magazine on its present lines, with the general aim of promoting among Observers interest in the science of meteorology, was secured by agreement. In 1916 the Meteorological Office had commenced the publication of a leaflet, for distribution principally among observers, entitled the "Meteorological

Office Circular." This provided a convenient means for the publication of official notices, changes in the observing staff, brief reviews of recent publications and other matter of general meteorological interest. It has now been decided that it is no longer necessary to continue the "Meteorological Office Circular" as a separate publication, and arrangements have accordingly been completed for the amalgamation of the two periodicals under the title of "The Meteorological Magazine." In order to avoid any unnecessary break of continuity the new combined magazine will be issued in 1920 as volume **55**. Mr. M. de Carle S. Salter, Superintendent of the British Rainfall Organization, to whom *Symons's Meteorological Magazine* has been entrusted since the retirement of Dr. H. R. Mill, in July, 1919, will be joined in the editorship by Mr. F. J. W. Whipple, Superintendent of the Statistical Division of the Meteorological Office.

Whilst becoming, as a matter of course, the organ of the combined meteorological services, the Magazine will, it is hoped, fully maintain its traditional character, as a channel of communication between amateur meteorologists.

The design for the new cover, a reproduction of which forms the frontispiece of this volume, was drawn by Mr. W. Hayes, and embodies suggestions due to Sir Napier Shaw. The bringing together of the four portraits, respectively of Admiral Fitzroy, Edward Sabine, Sir Richard Strachey and George James Symons, symbolizes effectively the convergence into a common track of the work of these pioneers of meteorological science and organization.

MACEDONIAN METEOROLOGY.

THE following notes describing meteorological phenomena of a local nature in Macedonia have been forwarded to us by Mr. A. Harrison, who has recently returned to England after two and a half years on the Salonica front.

MOUNTAIN CLOUD.

During the winter of 1916-1917 a heavy canopy of cloud enveloped the summit of the Belashitja range continuously for some fifteen days. The wind was moderate from the north and it appeared to me that the small amount of moisture in the air current was condensed on the snow-capped peaks and poured over to the southern side.

By day the cloud spread to the Zenith, but at night it decreased, until by dawn, only a narrow line of cloud remained. Sometimes a thin film of snow fell on the higher slopes. The cloud finally dispersed at the commencement of a period of broken weather.

Cloud Formation in Salonica.

On a clear bright day in March, 1918, artillery fire caused a dense column of black smoke to arise from a village on the Struma plain. The pillar ascended in a straight column to a great altitude finally spreading out in a canopy above. The air was motionless and visibility remarkably high. Soon, just above the smoke canopy a small white cumulus appeared. This steadily increased in size and about an hour later presented a massive appearance suggestive of a thunder-shower. Then the smoke column began to thin and at the same time the cloud stood out boldly against the clear blue. At about 5 p.m. a light breeze from the west drifted the cumulus away in an easterly direction. This is a clear case of an ascensional column of moisture laden air (the sky otherwise being quite cloudless) producing a cumulus cloud.

Thunderstorms in Macedonia.

Thunderstorms were of frequent occurrence during the month of May both in 1917 and 1918 among the hills. They were all of local origin, occurring between the hours of 2 and 5 p.m. Cumulus formed on the summits of the highest mountains, increasing steadily, until suddenly becoming condensed, when heavy rain and hail fell, accompanied by lightning and thunder. Generally the storms were of small compass and moved along the course of the Struma, several raging at once within a small area. The clouds were of great altitude, as lightning flashes overhead were not followed by thunder before ten or twelve seconds had elapsed and then the sound was muffled and indistinct. At sunset the sky was clear. The storms were mainly preceded by sharp gusts of wind.

In August, 1917, during a hot rainless spell a heavy cumulus suddenly formed over Lake Doiran. It assumed a nimbus appearance and considerable thunder and lightning took place. The cloud mass passed on overhead, with muffled thunder and every appearance of rain, but none fell. Rain had not fallen for some days before this, neither did any occur until five weeks later. The wind was westerly and the air dry, whilst the temperature maximum averaged about 95°. Could it be that the rain was evaporated before reaching the earth?

The autumn thunderstorms were more of the "travelling" kind, coming in from the sea and were always accompanied by a lot of wind. Watching the approach of such storms, I have heard thunder at a distance of twenty miles, there being some hundred seconds elapse between flash and peal. The thunder was remarkably audible, but perhaps the sea carried the sound across and the neighbouring hills caught the vibrations, acting as a sounding board.

THE RAINFALL OF 1919.

A PRELIMINARY survey of the 3,000 returns of rainfall in 1919 up to the present received enables us to form some idea of the general distribution of the year's fall in relation to the average. For this purpose we have confined ourselves to examining such records as have been carried on for a sufficient period to yield average values for 35 years. Of these some 230 are so far available.

The rainfall over England was nearly everywhere in excess of the average, the only important exception being in the north-west, but the excess was nowhere large, only reaching 10 per cent. in scattered patches, the largest of which extended from Malvern to the coast of south Lincolnshire. In the centre rather more than 20 per cent. excess occurred in Leicestershire. The English wet area was continued westward across North Wales, where part of Denbigh and Flint had more than 10 per cent. excess, but in South Wales the severe drought of the summer and autumn brought the year's rainfall well below the average, the deficiency being more than 10 per cent. in place. Parts of the east and north of Scotland had more than the average fall, the wettest districts being northern Aberdeenshire and the Orkneys, but from Inverness southward throughout the Scottish Midlands, and well into the north of England, the rainfall of the year was considerably below the average, the deficiency culminating in central Inverness-shire and Perthshire, where it exceeded 20 per cent. In Ireland the only areas with rainfall above the average were parts of the northern counties and a small patch in Co. Kildare. In the centre and south the fall was more than 10 per cent. below the average, the deficiency being more than 20 per cent. in Co. Cork and in eastern Galway and Kerry.

The general rainfall for the greater divisions of the country during each month was as follows :—

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Eng. & W...	155	103	196	124	41	62	74	85	79	59	82	155
Scotland ..	94	38	105	138	41	139	36	86	112	57	110	130
Ireland	122	69	112	72	120	105	45	81	97	41	79	156
British I. ...	124	71	143	113	62	96	55	84	94	54	91	147

Taking the British Isles as a whole the year, although by no means exceptional, was probably the driest since 1908, a result largely due to the persistent shortage of rain during the summer and autumn. The general rainfall calculated from about 200 stations was

England	33·59 in.	or	103	per cent. of average.
Wales	44·61 ,,		98	,,
England and Wales.....	35·59 ,,		102	,,
Scotland	40·70 ,,		92	,,
Ireland	35·81 ,,		90	,,
British Isles	37·03 ,,		96	,,

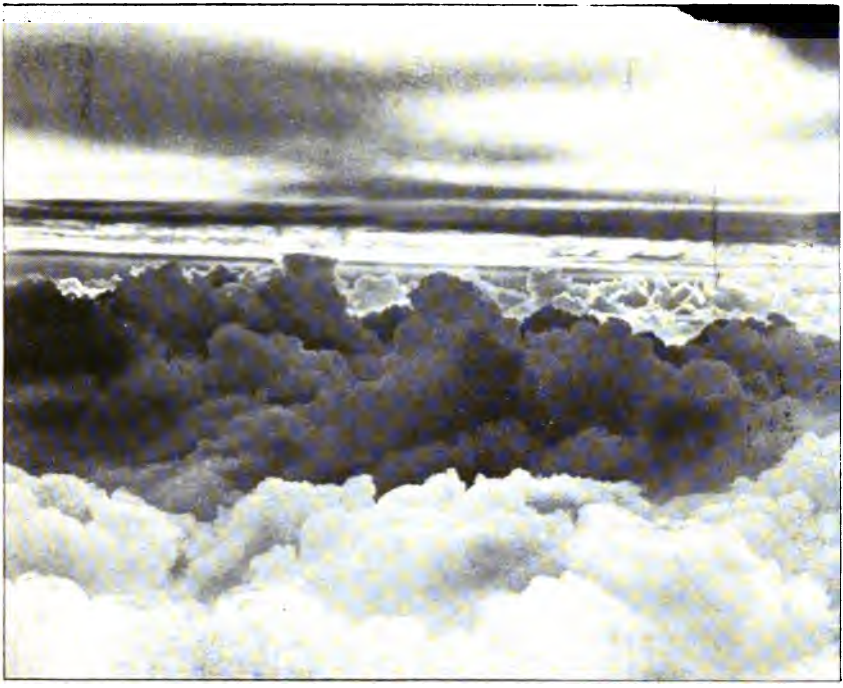


Fig. 3. Thunderclouds developing, August 25th, 1918.

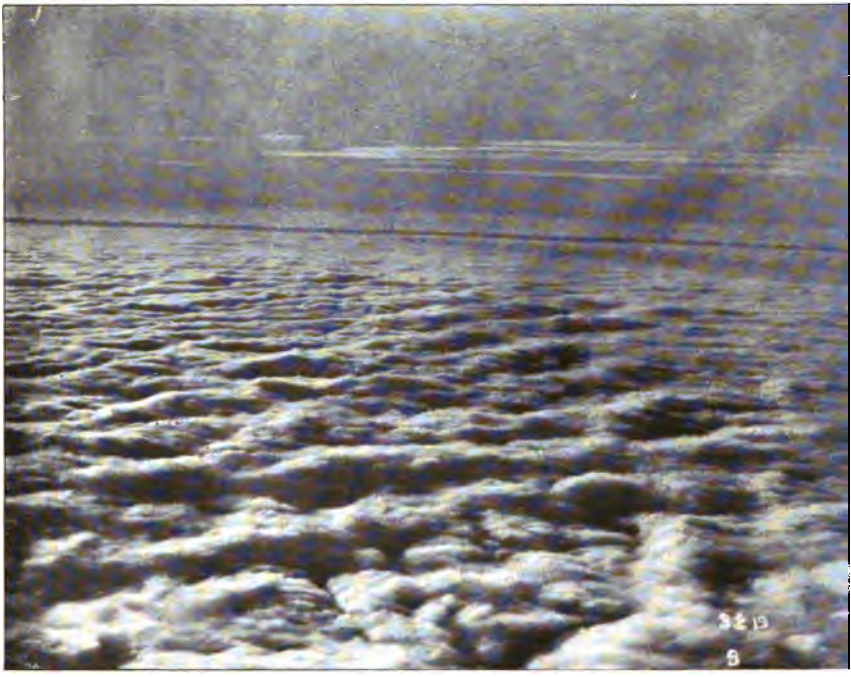


Fig. 4. Cloud-sheet at 2,500 feet, February, 3rd, 1919.

THE USE OF AEROPLANES IN METEOROLOGY.

By C. K. M. Douglas,
Late Pilot of the R.A.F.

(*Continued from p.* 130).

Reference was made in the previous article to the frequency of temperature inversions within or at the boundaries of anticyclones, which were attributed to the presence of layers of air which had descended and been dynamically warmed.

These inversions are an effective check to convection and mechanical churning, and in consequence the clouds are usually spread out in a horizontal sheet with the upper surface just below the inversion. The height of the inversion is often 8,000 feet or more near the north-east boundary of the anticyclone, but is lower near the centre. Showers or drizzle may develop below an inversion when the humidity is high. The showers are particularly apt to form when cold air is passing over a warmer sea, but they do not, as a rule, extend very far inland. On the south-west side of the anticyclone the warm dry descending air is usually close to the ground, but in summer over the land there is no inversion owing to the surface heating. This part of the anticyclone is often cloudless, but fogs are not infrequent in winter or over the sea.

In winter, east or north-east winds are often accompanied by cloud-sheets, with inversions above them, at the southern boundaries of anticyclones, or just outside them. Fig. 4 shows such a cloud-sheet with its upper surface at 2,500 feet moving from north-east, on February 3rd, 1919, in a spell of very cold cloudy weather. The ripples are across the current, and there is also a curious ridge in the background from north to south, which was thirty miles long. There are thin patches up above at 10,000 feet, which have some resemblance to cirrus, though they consisted of super-cooled water-drops. The photograph was taken from 5,000 feet, looking west over the sea, from a point five miles inland.

Even when there is no inversion there is not infrequently a comparatively stable layer at about 6,000 to 8,000 feet, which checks the growth of cumulus clouds. When the upper air is stable and also of low relative humidity, widespread or heavy rainfall cannot develop. But if the upper air is warm and damp, rainfall is quite common. A good deal of the rainfall in front of depressions is supplied by warm damp currents. J. Bjerknes,* of Bergen, has shown that the warm air is pushed out in the form of a wedge over cold air in front of the depression, causing rain; while the cold current behind the depression pushes under the warm air, also in the form of a wedge and causes another rainy area. These conclusions were reached as the result of detailed examination of the

* The Structure of Moving Cyclones, by J. Bjerknes. Monthly Weather Review, Vol. **47**, No. 2, (February, 1919), pp. 95-99.

surface winds combined with cloud observations, and they are confirmed by the observations of temperatures, clouds, and upper winds made in France. The cold air in front of depressions is less frequently present in France than it is further north, but there were a few occasions when there was a mass of cold air which belonged originally to the north-west current of a previous depression, and a warm current which pushed over it and caused rain. When the high and medium clouds come over before the rain the upper air temperature (*e.g.*, 10,000 to 14,000 feet) rose considerably, although in the lower air there was little or no increase. Sometimes the warm damp upper current which brings the rain is from north-west, having curved round from south-west, the colder wedge below moving slowly from south or south-west. Rain is much more likely to develop near the south-east boundary of a depression if there is cold air in front of it than when there is a large anticyclone, which is always warm (except close to ground in winter). The undermining of the warm air by the wedge of cold air along the trough of a depression was frequently observed in France, usually somewhere in the south-east quadrant, the cold air having curved round. The fall of temperature and veer of the wind (which may be slight) begins near the surface and works up. Behind the rain there is medium and high cloud in a wedge above the cold air and moving from a more southerly point, tapering away into a thin edge. Once the cold air is about 10,000 or 12,000 feet thick, showers frequently develop. On September 23rd, 1918, there was heavy rain in the early morning, and a few showers about noon, when the wedge of cold air was 10,000 feet thick, and much heavier though local showers in the evening when the cold air was over 15,000 feet thick, and Fig. 2 (reproduced in the previous number) was obtained. Two photographs taken at about the same time were reproduced in the *Journal of the Scottish Meteorological Society* (Vol. xviii, No. 35, 1918), showing false cirrus being carried away by a strong upper west-south-west current at 20,000 feet (above the cold wedge) and an anvil with a very flat top at that level. The effect of the upper current is just visible at the top of the cumulo-nimbus in Fig. 2.

No rule can be laid down as regards the upper air temperature in any particular part of a depression, as either warm or cold air may curve a long way round it. The north-west current is almost always cold. By "warm" it must be understood that what is implied is a temperature above the average corresponding to the pressure. A good deal of rainfall may be attributed to warm air pushing over cold air (or cold air undermining warm air) in a large variety of conditions. As air above the influence of the surface variations often only changes its temperature slowly and may follow a complicated path, there is a large variety of possible temperature distributions. This is borne out by the complexity of wind currents. The relation between the upper winds and the distribution of upper

air temperature and pressure are given in chap. vii. of Sir Napier Shaw's *Manual of Meteorology*, Part IV, on the assumption that the wind balances the pressure gradient at its level. The sequence of upper wind and temperature changes in France were consistent with that assumption, though there were a few cases where warm damp upper north-west currents in front of depressions may have had an outward component. Unfortunately the upper air temperature observations in other localities, which are required in order to confirm the existence of the outward component are wanting.

Steady rain due to this pushing of warmer air over colder air may fall from a fairly high level, from a uniform layer of clouds, without any "bumpiness" at all. This is frequently the case at the commencement of cyclonic rains, though low clouds afterwards develop. The rain-clouds extend up to a great height, usually to the cirrus.

The heavy rain sometimes experienced near or at the centre of depressions must often be due not to warm air being displaced by colder air, but simply to air converging at surface and rising up the cold core of the depression. For instance, there was very cold air on both sides of the centre of the depression which caused the heavy snowstorm of April 27th, 1919, and the whole area of the depression was certainly very cold, the heavy snowfall being due to the instability. The few days at the end of April were colder at 15,000 feet than any during the previous winter, except a few at the end of March. Depressions which move from a northerly point are always extremely cold, but the rainfall is not always heavy, being sometimes limited to showers. In order to understand rainfall development, a thorough investigation of the surface currents should be combined with upper air observations. The same is true for investigations of thunderstorms. Prof. V. Bjerknes, in a recent lecture to the Royal Meteorological Society, showed that thunderstorms often develop over points or along lines where the surface currents converge. The researches of J. Fairgrieve point to the same conclusion, and also to a wave structure in the movements which start the disturbance. The convergence of the lower currents lifts the strata above them and if there is a damp layer clouds form, which may grow into thunderstorms. The author has frequently observed the clouds first appear in a wave form, evidently due to an upward bulge, not to upward currents from the surface. Of course frequently the upward currents do start at the surface, but on other occasions the lower air may be quite stable and clouds appear at about 5,000 or 6,000 feet, which afterwards develop into thunderstorms. Fig. 3 shows clouds which developed with their base at 5,000 feet and developed upwards, the lapse of temperature above them being greater than the adiabatic for saturated air, though the lapse below them was less than the adiabatic for dry air. There was another layer above them at 10,000 feet, and the lower layer

had reached it in places. Ultimately the clouds developed into cumulo-nimbus causing moderate thunderstorms with their tops above 15,000 feet. The photograph was obtained over the sea looking west on the evening of August 25th, 1918. The upward movement was started by convergence in a small secondary. Clouds with turreted tops similar to the lower clouds in the photograph may develop high up (*viz.*, 15,000 to 20,000 feet), and indicate instability at those heights, which is a favourable factor for thunderstorm development. But this development can only take place when a layer of cloud is formed below 10,000 feet. A warm damp layer at about 5,000 feet is a favourable condition for thunderstorms. A southerly current may bring about such a condition provided that the air at 5,000 feet is not drawn from an anticyclonic source, in which case it would be too dry for clouds to form. Sometimes a warm damp southerly current has a cold surface north-east current under it, and variations in the depth of this cold current may cause the upward bulge which starts the cloud development.

When clouds form at a temperature of 55° or 60° F., the heat given out by condensation is so great that the clouds grow up if there is merely a normal lapse of temperature above them. When thunderstorms develop in cold weather it is usually found that the lapse of temperature from the surface to a great height is little below the adiabatic for dry air, so that the clouds grow to a great height in spite of the small amount of heat liberated by condensation.

A large number of upper air observations in thunderstorm conditions have already been made. A careful investigation of the wind currents in the lower air which start the disturbance, together with the causes of the favourable distribution of humidity and temperature up above, is the most fruitful line of research, and this can only be done by the combined effort of a powerful organization.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

WIND IN RELATION TO TIDE.

Referring to the communication on the above subject in your October number, it would, I think, be worth while asking Observers in the Conway Valley for evidence. Some years ago, when I spent several holidays at Llanbedr, near Tal-y-Cefn, there were many occasions when the wind appeared to shift with the turn of the tide, often to the opposite direction. F. R. WALTERS, M.D.

Pinecroft, Farnham, Surrey, November 18th, 1919.

SEVERE WINTERS.

At the threshold of winter there is usually a good deal of curiosity as to what the season may bring forth, meteorologically. An inquiry into the distribution of severe winters in the sunspot cycle might conceivably be helpful. Suppose we take the ten coldest winters at Greenwich since 1841, measuring by the mean temperature of the months December to February. The following are all the winters with mean temperature under 37°·0 in descending order (coldest first) :—1891, 1879, 1847, 1845, 1895, 1855, 1917, 1880, 1886, 1871 (1891 meaning 1890—1891 and so on). I will now specify these in the position they take in the following schedule :—

1 Min.	1	2	3	4	5	6	7	8	9
'55	'79	'91		'47		'95		'86	
		'45		'17					
		'80		'71					

It will be seen that seven of those ten winters occur in the four years following minima; that is, roughly, at a time when the sun's spottedness is growing, (the maximum is reached in about three to five years after the minimum) and three remain for the rest of the cycle, as shown. As we have now to do with the seventh year after a minimum, (1913), we are at a part of the cycle less "frequented," apparently, by those severe winters; but the induction is, of course, not a large one. The seventh year has none of the ten, and curiously its history in the previous six sunspot waves, shows no winter colder than 39°·3, which is but a trifle under the general average (39°·5).

We might take another view, by considering all winters under the higher limit of 38°·0—a total of twenty-two. The following table shows the numbers in each category (*a.*), and the result of smoothing with sums of 3 (*b.*) :—

	1	Min.	1	2	3	4	5	6	7	8	9	[10	11]
(*a.*)	3	0	1	3	2	5	1	2	0	2	2	[0	1]
(*b.*)		4	4	6	10	8	8	3	4	4			

The lower series indicates a wave culminating in the third year after minimum.

ALEX. B. MacDOWALL.

Bellevue, Bridge of Allan, 4th December, 1919.

SNOW FOLLOWING FINE WEATHER.

I should like to point out to Mr. Chas. P. Hooker that I have only followed in my remarks on this subject the received heading as above.

As in his last example, in 1918, snow followed five days later, he must not claim that example as a success.

H. NOWELL FFARINGTON.

Worden, Leyland, Lancs, January 3rd, 1920.

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting was held on Wednesday, December 17th, in the Society's Rooms, 70, Victoria Street, S.W., Sir Napier Shaw, F.R.S., President, in the Chair.

A paper by Mr. F. J. W. Whipple, M.A., entitled "The Laws of Approach to the Geostrophic Wind," was read. The mode of transition from the winds near the surface of the earth to the general current at moderate heights has been discussed by various authors. In the present paper stress is laid on the geometrical aspect of the question. The term "Relative wind velocity" being used for the velocity which must be combined with the geostrophic wind velocity by vector addition to give the actual wind velocity at any level, the laws of approach to the geostrophic wind are :—1. the relative wind turns uniformly with increasing height; 2. the relative wind decreases with increasing height according to the exponential law; 3. the actual wind at the surface and the relative wind there are inclined at 135°. The modification of the "laws" when departures from the ideally simple conditions they pre-suppose are allowed for, was discussed.

In the discussion which followed, Capt. D. Brunt called attention to Sverdrup and Heselberg's investigations in which the spiral is followed out nearly up to the height at which gradient direction begins and then tends to shoot off to the right. Mr. L. F. Richardson said that Eckman first discovered the equiangular spiral in 1905. He hoped Mr. Whipple would further generalize the spiral to fit the case in which eddy winds varied with height. The rapid variations in the first ten metres was often clearly shown by frozen snow on telegraph poles. Lieut.-Col. E. Gold said that the increase of velocity at relatively low altitudes was more rapid by night than by day. He had repeatedly found that at night the wind rose to a maximum velocity at 1,000 feet and then decreased; this did not often happen in the daytime. Sir Napier Shaw said that Mr. Whipple's paper would be a useful appendix to Maxwell's "Matter and Motion."

Mr. G. M. B. Dobson, M.A., read a paper on "Winds and Temperature Gradients in the Stratosphere." From the results of temperature observations by "ballons sondes" it can be shown that the horizontal pressure gradient and therefore the wind velocity should decrease rapidly on passing from the troposphere to the stratosphere. Previously there had been little confirmation of this by actual observations. Seventy ascents recorded by the International Commission gave data for temperature, wind velocity and wind direction to great heights. These showed that almost without exception, winds of moderate or great velocity in the troposphere, fell off very rapidly on entering the stratosphere, while the wind direction remained constant. On days with small pressure gradients this effect was not usually found; a result which was to be expected,

since the slope of the tropopause would then not necessarily be towards the low pressure. Horizontal pressure and temperature gradients calculated for the observed winds on typical days with moderate or large pressure gradients, show that the pressure gradient is suddenly reduced, and the temperature gradient suddenly reversed, on entering the stratosphere. The temperature gradients calculated from the observed wind velocities were in good agreement with those deduced by Mr. W. H. Dines, from temperature and pressure observations.

In a written communication, Mr. W. H. Dines pointed out that the correct measurement of upper winds depended upon an assumed uniform rate of ascent of the balloons. He had found the pressure gradient to be zero at about twenty kilometres. Lt.-Col. Gold said that if the ascentional velocity of a balloon increased, the increase of wind velocity must appear greater when the one-theodolite method of observation was employed. He discussed the effect of temperature change in the troposphere and in the stratosphere. Mr. Whipple said that the fact that the strongest winds were at the border between the stratosphere and troposphere indicated that the biggest centrifugal force was at that level and provided machinery for sucking in air from above and below. The actual distribution of pressure and temperature in cyclones indicated that they were regions in which air was being sucked up from above. Mr. Richardson, Mr. J. S. Dines and Mr. J. E. Clark also spoke.

A paper by Capt. C. J. P. Cave was entitled "Quotations from the Diary of Samuel Pepys on the Weather." The author had collected together all references to the weather from the diary, using for this purpose Wheatley's edition. These amounted to 557 entries, and were arranged in chronological order. They formed a brief comment on the general weather conditions prevailing from January, 1660 to May 1669. In a preliminary essay the author summarized the principal weather events for each year. He pointed out that Pepys cannot claim to be considered as a meteorologist, and that his references to the weather are such as any one might make in writing a diary or in correspondence. Pepys's memory for meteorological events was not always good, and his remarks on the worst or best weather he remembers must be taken with caution.

Sir Henry Lambert, exhibited a manuscript weather diary kept by his great grandfather, Daniel Lambert, in the years 1781-82. He believed the observations were made on Tower Hill, and arranged that a copy might be made and preserved in the library.

The following candidates were balloted for and elected Fellows of the Society :—Mr. N. C. Ahluwalia, Mr. F. W. Baker, Mr. G. A. Clarke, Lieut. W. M. Cooke, R.N.R., Mr. P. de Rome, Mr. V. A. Jarvis-Clark, Mr. E. M. Maurice, Capt. L. F. Plugge, R.A.F., Capt. H. H. M. Spink, Mr. G. Thomson, Jun., Mr. R. G. Veryard, Lieut. D. C. Way, R.N.R., and Mr. P. R. Zealley.

SCOTTISH METEOROLOGICAL SOCIETY.

THE Annual Business Meeting of the Scottish Meteorological Society was held in the Society's Rooms, Edinburgh, on 19th December, 1919, Dr. C. G. Knott, President, in the Chair.

The Report from the Council referred to the working arrangements made with the Meteorological Committee in 1913; to the necessity of securing an adequate skeleton system of climatological stations under some public control which should guarantee continuity and efficiency; and to the loss sustained by the deaths of Mr. J. Mackay Bernard and Dr. John Aitken. There had been a slight increase in the membership list during the past year.

The Council had decided to regard the meeting held towards the end of each year as a purely business meeting for consideration of the Annual Reports and the election of Office-Bearers and Council. It was proposed, however, to hold a series of meetings, mainly in Edinburgh, at which lectures on popular lines will be given, or discussions opened, on questions of meteorological interest. The first of these lectures had indeed already been given in Glasgow by Captain Franklin, who opened the winter session of the Royal Philosophical Society of Glasgow by an address on "The Study of Meteorology in Schools and Universities." Other lectures were to be delivered in Edinburgh after Christmas.

The following Council and Office-Bearers were elected for the ensuing twelve months:—*President:* Dr. C. G. Knott; *Vice-Presidents:* Prof. T. Hudson Beare, and Mr. D. A. Stevenson; *Honorary Secretary:* Dr. E. M. Wedderburn, W.S.; *Honorary Treasurer:* Mr. W. B. Wilson, W.S.; *Council:* Mr. S. B. Hog, Mr. G. Thomson, Dr. A. Crichton Mitchell, Mr. G. A. Mitchell, Mr. M. M'Callum Fairgrieve, Prof. R. A. Sampson, F.R.S., Captain T. Bedford Franklin, Sir R. B. Greig, LL.D. and Mr. T. S. Muir.

REVIEWS.

Nedbørjagttagelser i Norge. Aargang xxiv., 1918. Christiania, 1919. Size, 14½ × 11. Pp. xii. + 128. One chart and 11 figures in text. Price, 6·00 kr.

WE should be lacking in the ordinary attributes of humanity if we were able to conceal a gleam of satisfaction that the magnificent Norwegian Rainfall Annual has at last dropped behind *British Rainfall* in the race for prompt publication in which it has so frequently carried off the palm. Glancing at the large mass of orderly statistics which it embodies, and bearing in mind the difficulties which surround the study of rainfall in a country like Norway, we can only wonder at the fact that its appearance is not more often delayed.

We note with interest the use of a novel form of rain gauge glass which overcomes the difficulty of accurately measuring small quantities, by means of a cone-shaped glass bottom with the apex upwards, the inverse of the device used in the "Camden" glass familiar in this country. It is probable that the meniscus difficulty is minimised in this way. The climatic peculiarities of the country make necessary the wide use of the Nipher shield for the prevention of loss by eddying, a hint which might well be taken to heart in some of the more exposed districts in the British Isles.

A finely reproduced rainfall map, on the scale of about twenty miles to an inch, present the year's records in a cartographical form. The distribution is highly orographical and presents many points of similarity to that in the West Highlands. The amounts recorded are, however, greatly inferior to those on our own western mountain barriers, rising only very locally above 2,000 mm. (79 inches), and falling to one-tenth of that amount at one or two places within the Arctic Circle. C.S.

Journal of the Scottish Meteorological Society. Vol. xviii. Third Series, No. xxxvi., 1918. Size, 11 × 7. Pp. 121. One plate. Price, 12s. 6d.

THE appearance of the Journal of the Scottish Meteorological Society is always welcome, and our own editorial struggles with adverse circumstances lead us readily to condone its somewhat tardy publication. The volume, for although issued between paper covers it attains that dignity, contains interesting and suggestive articles on some of the most recent developments of meteorological work.

Lt.-Col. E. Gold, F.R.S., betrays a wealth of knowledge and experience in his treatment of the relation between meteorology and aviation, especially in respect of accurate short-period forecasts.

Capt. T. B. Franklin contributes an instructive article on Meteorology and Agriculture; and C. K. M. Douglas an interesting paper on Optical Phenomena and the Composition of Clouds, a subject on which his keen meteorological instinct and exceptional opportunities for observation render his views peculiarly valuable. A fourth article by E. M. Wedderburn on Meteorology and Gunnery sets down some of the applications of meteorology to ballistics, which became of great importance during the war.

The usual statistical tables dealing with the Climatology of Scotland are given, including complete monthly rainfall records for 730 stations. It may perhaps be mentioned it has been the custom for many years past for these rainfall tables to be compared in detail with those sent to the British Rainfall Organization in order to eliminate errors and provide a means for the exchange of records received by only one of the two bodies. C.S.

A Continuous Record of Atmospheric Nucleation. By Carl Barus. Smithsonian Inst., Washington, 1905. Size, $9\frac{1}{4} \times 12\frac{1}{2}$. Pp. 226.

In this memoir Prof. Barus discusses the phenomenon which he entitles "Atmospheric Nucleation," and continues the researches described under "Experiments with Ionized Air" and "Structure of the Nucleus" in the Smithsonian Contributions to Knowledge, volume xxix., 1901 and 1903. The present volume consists of 226 large quarto pages, and describes only a part of the research which the author stated was being further continued. It is necessary for an intelligent appreciation of the work to refer to the preceding publications.

Professor Barus describes the nucleus as "at the outset simply a dust particle, small enough to float in the air, but much larger than the order of molecular size." He considers it one of the main features in bringing about the condensation of water from the atmosphere. Such nuclei, he states, are formed by agitating liquids such as by jets inpinging on obstacles and by combustion, *i.e.*, smokeless combustion. In addition to the mechanical, thermal, and chemical processes, he says high potential is a fruitful source of nuclei, such as a body highly charged with electricity. Also certain radiations, as ultra-violet light, x-rays, and radio-active bodies generate nuclei in air through which the radiation passes.

By the term nucleation is meant the number of such nuclei per cubic centimetre. Professor Barus holds that the nucleus is distinct from the ion, but that ionization is always accompanied by nucleation; he thinks nucleation owes its origin to the expulsion or absorption of the corpuscles representing the concomitant ionization. It is not very clear how under these circumstances the nucleus can exceed molecular dimensions as stated above.

The method of measuring nucleation and size of particles by the colour and diameter of "coronas" is used; the corona is observed when a beam of light is transmitted through the nucleated gas, and is a diffraction phenomenon more fully described in "the Structure of the Nucleus" above referred to.

The greater part of the volume is taken up with descriptions of apparatus and experiments. In chapter 7 a method is developed for the measurement of fog particles by means of the microscope. Chapter 9 is, perhaps, of the greatest interest to meteorologists, as it gives a record of over two years' observations of atmospheric nucleation in the City of Providence. It is shown that the maximum and minimum nucleation occurs at about the winter and summer solstices respectively. Much of the nucleation is attributed to combustion, and it is shown that generally speaking the cold weather causes a rise of nucleation, while rain or snow produces a fall; although snow, if dry, may even cause an increase. Tables and graphs of these results are given, and the graph showing the monthly nucleation for 1902 to 1904 shows the remarkable maximum

which occurs about the middle of December, and a less well defined minimum about July.

The work is a useful record of experiments bearing on condensation apart from the particular explanations suggested as accounting best for the phenomena observed. J. S. OWENS.

THE ATLANTIC TYPE OF DECEMBER WEATHER.

By L. C. W. Bonacina.

In England the depth of winter may manifest itself either by intense cold—the Arctic type, or by excessive damp—the Atlantic type. The latter type, the more common yet styled "unseasonable," is connected with the fact that the Atlantic Ocean is ceaselessly throwing off large quantities of vapour at a temperature much too high for the latitude belt between 50 and 60° N., and in the gloomy, damp heat from the stormy ocean, which characterizes it one simply sees the winter season in a dark garb instead of the more conventional white one. In this latitude warmth in winter almost invariably means weather of a severely rough and wet description, and the usual designation of such weather as "mild" in relation to the temperature only, is to put it mildly, rather unfortunate. This year the hard frost of early November gave place soon after the middle of the month to this other form of winter, which continued right through December. On many nights during the latter part of November and December, the deep roar of the great Atlantic gales—the true voice of the English winter—was very impressive. Heavy cyclonic gales are as much a climatic feature of midwinter as violent thunderstorms are of midsummer, and they are just as inspiring to the imagination. The close of December, 1919, was conspicuous for incessant rain, the intervals between the different quick-travelling bad weather systems being very brief and uncertain. A raw murky-looking morning with a touch of frost would be the sure precursor of another downpour by evening. To pedestrians and lovers of the open air excessive winter wet in place of invigorating frost and snow is very trying on account of the continual changing and drying of clothes which their outdoor habits render necessary. But the Atlantic type of weather brings its compensations in the form of a pure sweep of S.W. wind from the ocean, and in the soft transparency of the atmosphere during the finer intervals. Moreover, in open weather the forms of the forest trees loom out with a blackness and vividness as the branches sway in the gale, that is missing in the thicker atmosphere that prevails when the countryside is frost-bound and deep under snow.

METEOROLOGICAL NEWS AND NOTES.

MR. M. DE CARLE S. SALTER delivered a lecture entitled "Rainfall considered as a Geographical Function," at the meeting of the Geographical Association, at the London Day Training College, January 10th.

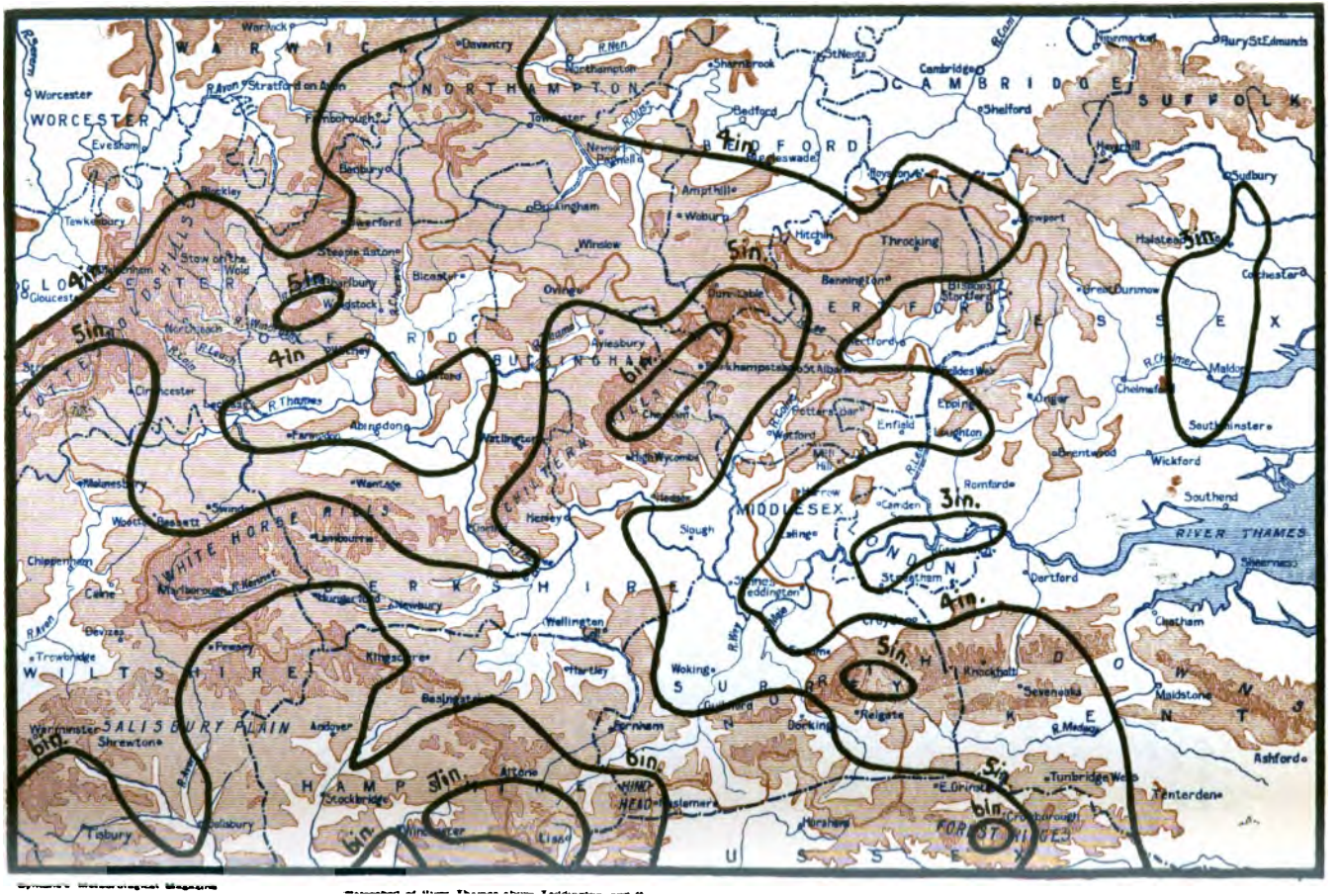
METEOROLOGICAL OFFICE RETIREMENTS:—The following members of the Staff of the Meteorological Office retired on December 31st, 1919 :—

	Period of Service.
Mr. F. J. Brodie ..	April, 1869—Dec. 1919.
Mr. W. G. James ..	May, 1869— 1875.
	and Mar. 1879—Dec., 1919.
Mr. J. Sheerman ..	Feb., 1882—Dec., 1919.
Mr. R. F. Wallace ..	Feb., 1883—Dec., 1919.

Mr. Frederick J. Brodie has been a frequent contributor to the pages of this magazine and has been for many years past the author of the regular articles on the "Weather of the Month," which replaced the "Meteorological Notes on the Month" by substituting a connected narrative for the fragmentary remarks of the Observers. For this task his professional experience rendered him peculiarly fitted. He was for a very long time the Meteorological correspondent of *The Times*. Mr Brodie is one of the small group of senior members of the staff of the Meteorological Office whose term of service extended back to the administration of Admiral Fitzroy, having begun his work more than half a century ago. We wish him many years of peaceful life in retirement.

WEATHER CONTROLS over the fighting during the summer of 1918 are discussed by Prof. R. De C. Ward, in an interesting paper in the *Scientific Monthly*, for October, 1918. Instances are quoted of of the great effects produced in military operations in France by decreased mobility of the armies after heavy rain: and of the advantages gained by attacks in fogs (especially at night), in thunder storms which drowned the noise of barrage fire and of favourable winds in gas attacks. On the Austro-Italian front particular mention is made of the flooding of the Piave, leading to shortage of Austrian supplies and consequent defeat from Montello to the sea. Of the other fronts, Mesopotamia occupies the author's special attention, as climate is there "the first thing to be taken into consideration in every move that is made." The meteorological feature of the desert, the mirage, has curiously to be included since in the early days of the campaign the Turks apparently saw the British supply and ambulance train "magnified and multiplied by the deceptive desert atmosphere," and fled. Food supply as a factor of military importance renders necessary the discussion of the influence of climate on crops in enemy countries.

THAMES VALLEY RAINFALL DECEMBER, 1919.



THE WEATHER OF DECEMBER.

An abnormally cold November gave place to a period in which winds from some westerly quarter (from between S.W. and N.W.) were largely in evidence. As regards temperature the contrast between the two months was therefore very striking. In November midday shade readings of 50° and upwards were rare; in December they were of common experience, the highest being reported over England on the 2nd or 3rd, and at some of the Irish stations on the 4th or 5th. In each case the thermometer rose to 55° in several places, and at Worksop on the 3rd it touched 56°. The months was, however, not uniformly mild. Between the 8th and 10th, when a ridge of high barometric pressure passed eastwards across the United Kingdom, sharp frost was experienced in most districts, the sheltered thermometer falling on the night of the 8th or 9th to 25° or less in many parts of Great Britain, to 22° at Rothamsted and Geldeston, near Beccles, and to 20° at Balmoral. On the surface of the grass the minimum readings at this time were as low as 12° at Greenwich, 14° at Wisley and 15° at Tunbridge Wells. Another rather sharp frost occurred on the night of the 16th, and a far sharper one in Scotland on Christmas night. On the latter occasion the sheltered thermometer fell to 16° at West Linton (Perthshire) and 14° at Balmoral and Eskdalemiur; while on the surface of the grass it sank to 14° at Crathes, 12° at Balmoral and 10° at West Linton.

The mild weather which was so general at other times was due to oceanic winds blowing around deep cyclonic systems whose central areas travelled eastward across Iceland, or between Iceland and our own northern coasts. The passage of these disturbances was accompanied in most instances by heavy falls of rain, and in many cases by a serious increase in the strength of the wind. On the 2nd, when a secondary line-squall passed across England, the wind over our southern counties, rose, in gusts, to a velocity of 68 miles an hour at Kew, Brighton and Plymouth, 72 miles at Shoeburyness and 74 miles at Pendennis Castle (Falmouth). On the 18th or 19th, when a similar movement in pressure took place, the more northern districts were chiefly affected, the westerly to north-westerly gusts reaching a velocity of 70 miles an hour at Paisley and Alnwick Castle, and 78 miles at Southport. In not a few instances the sudden shift of wind from S.W. to N.W. was accompanied by thunder and lightning. At Kew a short by sharp thunderstorm was experienced on the 4th and again on the 6th, the occurrence of two such phenomena in December being without precedent in the records of the past 40 years.

In spite of the changeability of the weather the total duration of bright sunshine at some of the western stations was appreciably in excess of the average.

The rainfall of the month was above the average, practically everywhere, in one or two places reaching twice the average. Less than 4 inches was confined to small areas in the south Midlands, and parts of the east of Great Britain, and in Ireland only to a small strip round Dublin. More than 6 inches fell over considerable areas in the south of England, in the north-east of Scotland and Ireland, and practically everywhere in the west. More than 10 inches occurred over wide areas of the uplands. The general rainfall expresssed as a percentage of the average was as follows :—England and Wales, 155; Scotland, 130; Ireland, 156, and British Isles, 147.

In London (Camden Square) the month was unusually showery and mild. Rain fell on all but 5 days, and a rain spell lasted from the 13th to 31st. Mean temperature, 42°·7, or 3°·0 above the average. Duration of rainfall, 75·4 hours. Evaporation, ·06 inch.

RAINFALL TABLE FOR DECEMBER, 1919.

STATION.	COUNTY.	RAINFALL.						
		Aver. 1875–1909. in.	1919. in.	Diff. from Av. in.	Per cent. of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days
Camden Square	*London*	2·13	3·47	+1·34	163	·85	1	27
Tenterden	*Kent*	2·77	3·38	+ ·61	122	·51	1	26
Arundel (Patching)	*Sussex*	2·91	6·08	+3·17	209	1·20	15	23
Fordingbridge (Oaklands)	*Hampshire*	3·35	6·14	+2·79	183	1·20	1	28
Oxford (Magdalen College)	*Oxfordshire*	2·06	3·82	+1·76	185	1·04	1	25
Wellingborough	*Northampn*	2·13	3·33	+1·20	156	·58	1	23
Bury St. Edmunds (Westley)	*Suffolk*	2·14	4·31	+2·17	201	·71	1	23
Geldeston [Beccles]	*Norfolk*	2·07	3·49	+1·42	169	·41	7	24
Polapit Tamar [Launceston]	*Devon*	4·46	7·83	+3·37	176	1·14	1	29
Rousdon [Lyme Regis]	,,	3·68	5·04	+1·36	137	·83	1	27
Ross (Birchlea)	*Herefordshr.*	2·71	3·28	+ ·57	121	·48	1	28
Church Stretton (Wolstaston)	*Shropshire*	2·99	4·69	+1·70	157	·52	1	23
Boston	*Lincoln*	1·88	3·75	+1·87	200	·63	1	28
Worksop (Hodsock Priory)	*Nottingham*	2·17	3·35	+1·18	154	·76	15	20
Mickleover Manor	*Derbyshire*	2·38	4·17	+1·79	175	·80	22	24
Congleton (Buglawton Vic.)	*Cheshire*	2·89	4·67	+1·78	162	·64	22	28
Southport (Hesketh Park)	*Lancashire*	3·10	4·39	+1·29	142	·90	22	25
Wetherby (Ribston Hall)	*York, W.R.*	2·27	3·85	+1·58	170	·65	26	14
Hull (Pearson Park)	,, *E.R.*	2·32	3·50	+1·18	151	·50	26	26
Newcastle (Town Moor)	*North'land*	2·46	3·01	+ ·55	122	·64	15	22
Borrowdale (Seathwaite)	*Cumberland*	15·14	16·85	+1·71	111	...	...	...
Cardiff (Ely)	*Glamorgan*	4·70	8·64	+3·94	184	·88	1	29
Haverfordwest	*Pembroke*	5·18	8·51	+3·33	164	1·36	10	30
Aberystwyth (Gogerddan)	*Cardigan*	4·66	...	...	...	...	...	...
Llandudno	*Carnarvon*	2·84	5·73	+2·89	202	1·17	22	25
Cargen [Dumfries]	*Kirkcudbrt.*	4·84	7·77	+2·93	161	1·00	10	26
Marchmont House	*Berwick*	2·83	4·24	+1·41	150	·93	15	20
Girvan (Pinmore)	*Ayr*	5·48	10·48	+5·00	191	1·96	10	26
Glasgow (Queen's Park)	*Renfrew*	3·95	5·83	+1·88	148	·58	30	27
Islay (Eallabus)	*Argyll*	5·73	7·85	+2·12	137	·88	26	29
Mull (Quinish)	,,	6·59	7·72	+1·13	117	·76	1	29
Loch Dhu	*Perth*	9·48	14·35	+4·87	151	1·90	10	28
Dundee (Eastern Necropolis)	*Forfar*	2·67	4·18	+1·51	157	·94	30	23
Braemar	*Aberdeen*	3·13	6·06	+2·93	194	·90	22	22
Aberdeen (Cranford)	,,	3·43	5·91	+2·48	172	1·55	15	22
Gordon Castle	*Moray*	2·72	2·28	— ·44	84	...	...	...
Drumnadrochit	*Inverness*	3·76	3·51	— ·25	93	·60	21	19
Fort William	,,	9·41	7·96	−1·45	85	·70	5	27
Loch Torridon (Bendamph)	*Ross*	9·71	7·98	−1·73	82	·91	26	24
Dunrobin Castle	*Sutherland*	3·09	3·85	+ ·76	125	·55	24	16
Glanmire (Lota Lodge)	*Cork*	5·29	4·97	— ·32	94	·60	10	28
Killarney (District Asylum)	*Kerry*	6·92	7·16	+ ·24	103	·85	30	29
Waterford (Brook Lodge)	*Waterford*	4·32	5·95	+1·63	138	1·14	10	28
Nenagh (Castle Lough)	*Tipperary*	4·34	6·47	+2·13	149	·68	10	29
Ennistymon House	*Clare*	5·03	7·52	+2·49	149	·79	30	31
Gorey (Courtown House)	*Wexford*	3·42	5·13	+1·71	150	1·35	10	24
Abbey Leix (Blandsfort)	*Queen's Co.*	3·41	5·84	+2·43	171	1·11	10	29
Dublin (Fitz William Square)	*Dublin*	2·27	3·48	+1·21	153	·60	14	24
Mullingar (Belvedere)	*Westmeath*	3·39	6·05	+2·66	178	·74	11	28
Crossmolina (Enniscoe)	*Mayo*	6·11	10·26	+4·15	168	1·21	30	31
Cong (The Glebe)	,,	5·42	8·30	+2·88	153	1·43	29	29
Collooney (Markree Obsy.)	*Sligo*	4·34	7·78	+3·44	179	·93	30	31
Seaforde	*Down*	3·77	8·21	+4·44	218	1·36	22	24
Ballymena (Harryville)	*Antrim*	3·97	6·60	+2·63	166	·98	22	30
Omagh (Edenfel)	*Tyrone*	3·91	9·14	+5·23	234	1·46	22	31

SUPPLEMENTARY RAINFALL, DECEMBER, 1919.

Div.	STATION.	Rain inches.	Div.	STATION.	Rain inches
II.	Sevenoaks, Speldhurst Close.	4·52	XI.	Lligwy	5·41
,,	Ramsgate	2·74	,,	Douglas, Isle of Man	7·25
,,	Hailsham	5·00	XII.	Stoneykirk, Ardwell House...	6·89
,,	Totland Bay, Aston House...	5·58	,,	Carsphairn, Shiel	15·76
,,	Stockbridge, Ashley..	6·26	,,	Langholm, Drove Road	8·27
,,	Grayshott	6·50	XIII.	Selkirk	4·10
,,	Ufton Nervet	5·57	,,	North Berwick Reservoir	2·85
III.	Harrow Weald, Hill House...	4·34	,,	Edinburgh, Royal Observaty.	3·14
,,	Pitsford, Sedgebrook	3·96	XIV.	Biggar	5·80
,,	Woburn, Milton Bryant	4·40	,,	Maybole, Knockdon Farm ...	7·52
,,	Chatteris, The Priory	3·65	XV.	Shiskine	11·17
IV.	Elsenham, Gaunts End	3·79	,,	Ardgour House	9·86
,,	Rayleigh	2·28	,,	Oban	...
,,	Colchester, Hill Ho., Lexden	3·32	,,	Holy Loch, Ardnadam	13·68
,,	Aylsham, Rippon Hall	4·61	,,	Loch Venachar	10·65
,,	Swaffham	4·59	XVI.	Glenquey	7·00
V.	Bishops Cannings	5·25	,,	Loch Rannoch, Dall	7·09
,,	Weymouth	4·74	,,	Aberfeldy, Dunros	5·93
,,	Ashburton, Druid House	10·18	,,	Coupar Angus	4·83
,,	Cullompton	6·55	,,	Montrose, Sunnyside Asylum.	4·80
,,	Lynmouth, Rock House	7·69	XVII.	Balmoral	4·08
,,	Mortonhampstead	6·59	,,	Fyvie Castle	3·50
,,	Hartland Abbey	6·10	,,	Keith Station	3·58
,,	St. Austell, Trevarna	8·02	XVIII.	Rothiemurchus	3·54
,,	North Cadbury Rectory	5·52	,,	Loch Quoich, Loan	19·60
VI.	Ledbury, Underdown	3·41	,,	Skye, Dunvegan	10·54
,,	Clifton, Bishop] Stoke	5·99	,,	Fortrose	2·23
,,	Shifnal, Hatton Grange	3·47	,,	Glencarron Lodge	8·40
,,	Droitwich	3·38	XIX.	Tongue Manse	3·98
,,	Blockley, Upton Wold	4·01	,,	Melvich	3·87
VII.	Grantham, Saltersford	3·33	,,	Loch More, Achfary	7·19
,,	Louth, Westgate	3·21	XX.	Dunmanway, The Rectory	10·10
,,	Mansfield, West Bank	4·19	,,	Mitchelstown Castle	5·53
,,	Derby, Midland Railway	3·68	,,	Gearahameen	14·90
VIII.	Nantwich, Dorfold Hall	5·12	,,	Darrynane Abbey	7·34
,,	Bolton, Queen's Park	7·83	,,	Clonmel, Bruce Villa	4·00
,,	Lancaster, Strathspey	5·89	,,	Roscrea, Timoney Park	5·54
IX.	Wath-upon-Dearne	2·89	,,	Broadford, Hurdlestown	6·87
,,	West Witton	4·15	XXI.	Enniscorthy, Monksgrange..	7·60
,,	Scarborough, Scalby	3·49	,,	Rathnew, Clonmannon	5·06
,,	Ingleby Greenhow	4·17	,,	Hacketstown Rectory	7·06
,,	Mickleton	4·20	,,	Ballycumber, Moorock Lodge	5·78
X.	Bellingham, High Green Manor	4·86	,,	Balbriggan, Ardgillan	5·21
,,	Ilderton, Lilburn Cottage	4·35	,,	Castle Forbes Gardens	6·08
,,	Keswick, The Bank	8·69	XXII.	Ballynahinch Castle	9·05
,,	Orton	8·29	,,	Woodlawn	5.08
XI.	Llanfrechfa Grange	7·40	,,	Westport House	7·81
,,	Treherbert, Tyn-y-waun	18·73	,,	Blacksod Point	9·15
,,	Carmarthen, The Friary	7·54	XXIII.	Enniskillen, Portora	7·54
,,	Fishguard, Goodwick Station.	6·64	,,	Dartrey [Cootehill]	7·25
,,	Crickhowell, Tal-y-maes	5·50	,,	Warrenpoint, Manor House	7.41
,,	Birmingham WW., Tyrmynydd	12·27	,,	Belfast, Cave Hill Road	7·45
,,	Lake Vyrnwy	10·90	,,	Glenarm Castle	6·66
,,	Llangynhafal, Plas Drâw	5·09	,,	Londonderry, Creggan Res...	7·03
,,	Rhiwbryfdir	17·23	,,	Milford Manse	8·03
,,	Dolgelly, Bryntirion	13·50	,,	Killybegs	10·93

ERRATUM.—November, 1919, at Swaffam, *for* 2·61 *read* 1·88.

Climatological Table for the British Empire, July, 1919.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain Depth.	Days.	Aver. Cloud
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	82·3	11	43·2	9	68·9	51·5	51·0	75	127·8	42·2	1·75	14	7·6
Malta	103·6	13	67·0	17*	84·4	20·9	...	73	153·0	...	·00	0	2·5
Lagos	89·0	8	69·2	21	81·6	73·1	72·4	83	161·4	57·5	·86	6	7·6
Cape Town	69·8	28	34·1	[illegible]	60·8	45·3	46·8	79	...	...	3·80	13	5·2
Johannesburg	68·2	1	34·1	19	62·7	42·6	37·2	69	...	...	·05	2	2·6
Mauritius	76·6	14	57·2	23	74·1	61·5	58·1	73	...	49·8	2·55	27	6·5
Bloemfontein	70·4	1, 2	20·5	15	63·9	32·6	31·1	65	...	...	·39	[illegible]	[illegible]
Calcutta...	94·4	29	75·5	12	88·6	79·1	78·0	87	...	74·1	11·99	15	9·1
Bombay	87·9	17	75·4	2	85·4	78·4	76·9	85	134·2	72·2	24·49	30	7·9
Madras	102·2	3	73·5	11	94·3	78·2	72·8	73	154·3	72·9	6·16	12	6·3
Colombo, Ceylon ...	88·4	18	73·7	28	85·3	76·7	73·4	80	156·9	70·8	4·26	23	8·
Hongkong	90·8	3	73·5	4	86·4	78·3	75·4	81	...	...	19·43	13	6
Sydney	74·0	21	38·5	16	63·6	45·7	41·7	68	120·3	38·6	2·02	7	3·5
Melbourne	61·9	25	31·0	17	55·3	42·0	39·4	68	107·6	22·0	2·34	19	6·3
Adelaide	68·6	24	36·8	27	60·2	44·5	43·5	70	125·2	25·2	1·39	15	5·7
Perth	74·1	17	40·5	12	65·5	50·9	49·9	77	131·7	32·4	2·76	19	6·0
Coolgardie	79·8	18	34·8	12	66·0	45·7	43·2	60	136·2	34·8	1·38	5	4·4
Brisbane	73·0	30	40·6	5	69·6	49·7	46·2	59	128·1	30·8	·18	4	2·9
Hobart, Tasmania ..	60·6	25	33·8	14	52·1	39·5	37·0	68	111·2	26·4	2·20	1[illegible]	5·[illegible]
Wellington	57·7	13	32·0	8	53·4	42·3	42·2	81	107·0	...	3·05	18	6·9
Jamaica, Kingston ...	95·2	27	71·8	15	90·6	74·0	72·2	77	...	...	·60	5	4·5
Grenada	87·0	17	72·0	4	85·0	75·0	...	78	137·0	...	8·09	24	4·0
Toronto	96·0	4	52·0	11	84·9	61·6	58·6	67	134·9	48·4	3·20	7	3·8
Fredericton	92·5	5	46·5	9	78·4	54·7	58·0	72	...	...	3·22	9	5·5
St. John, N.B. ...	82·0	20	47·0	1	67·9	52·6	54·2	83	140·7	42·8	4·52	11	6·2
Victoria, B.C.	84·5	14	47·2	1	66·4	50·6	49·0	76	140·0	39·4	·02	1	2·3

* 19, 20.

Johannesburg.—Bright sunshine, 276·5 hours.

Mauritius.—Mean temp. 0°·5 below, dew point 1°·4 below, relative humidity 2·0 below, and R. ·06 in. above, respective averages.

COLOMBO, CEYLON.—Mean temp. 0°·1 below, dew point 0°·6 below, and R. 1·86 in. below, averages. Mean velocity of wind 5·3 miles per hour, prevailing direction W.S.W.

HONGKONG.—Bright sunshine, 241·4 hours. Mean velocity of wind 12·4 miles per hour, prevailing direction E.S.E. Mean temperature 81°·8.

Melbourne.—Mean temperature normal, R. ·52 in. below average.

Adelaide.—R. 1·26 in. below average.

Perth.—R. 0·47 in. above average.

Coolgardie.—R. ·40 in. above average.

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